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Monterey, California

THESIS

COMMUNICATIONS PROCESSOR FOR
C^3 ANALYSIS AND WARGAMING

by

Lloyd Neil Clark
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Robert Lee Rapp

March 1982

Thesis Advisor: S.H. Parry

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This thesis developed the software capability to allow the investigation of C3 problems, procedures and methodologies. The resultant communication model, while independent of a specific wargame, is currently implemented in conjunction with the McClintic Theater Model (MTM). It provides a computerized message handling system (C3 Model) which allows simulation of communication links (circuits) with user-definable delays; garble and low rates; and multiple circuit types, addressees, and levels of command.

It is designed to be used for test and evaluation of command and control problems in the areas of organizational relationships, communication networks and procedures, and combat doctrine or tactics.

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Communications Processor for C3 Analysis and Gaming

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ABSTRACT

This thesis developed the software capability to allow the investigation of C3 problems, procedures and methodologies. The resultant communication model, while independent of a specific wargame, is currently implemented in conjunction with the McClintic Theater Model (MTM). It provides a computerized message handling system (C3 Model) which allows simulation of communication links (circuits) with user-definable delays; garble and loss rates; and multiple circuit types, addressees, and levels of command. It is designed to be used for test and evaluation of command and control problems in the areas of organizational relationships, communication networks and procedures, and combat doctrine or tactics.

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ABBREVIATIONS

ACCAT	Advanced Command & Control Architectural Testbed
ARPANET	DOD Packet-Switched Computer Network
C2	Command and Control
C3	Command, Control & Communications
CPU	Central Processing Unit
CR	Carriage Return
DCL	Digital Control Language
DEC	Digital Equipment Corporation
IBM	International Business Machines
JTIDS	Joint Tactical Information Distribution System
MTM	McClintic Theater Model
NOSC	Naval Ocean Systems Center
NPS	Naval Postgraduate School
TELNET	Telephone Network for Intercomputer Connection
VAX	DEC 11/780 Model Computer
VMS	Virtual Memory System
VT-100	DEC Video Terminal, Model 100
WES	Warfare Environmental Simulator

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I. INTRODUCTION

One of the most vexatious problems facing Defense Department analysts is how to evaluate Command Control and Communications (C3) systems. While there are a myriad of models, both computerized and manual, available to evaluate the effectiveness of operational tactics and procedures, very few tools exist to aid in the analysis of command and communication structures.

An effort was made by Stack and Secorsky [Ref. 1] to provide such a tool at the Secure Command Control and Communication Exercise Laboratory. The product of their thesis was computer software for a user-defined communications network supporting a multi-level chain of command which allowed for communications delays, garbled messages, message loss and player attrition. This communications model used the Navy's Warfare Environmental Simulator (WES) as a gaming framework and was implemented on the DEC 11/70 computer in the Secure C3 laboratory at NPS.

The Stack/Secorsky model was only partially successful for two major reasons. First, the model allowed for only one communication channel between any two players. As a result, it is difficult to experiment with partial circuit losses or degradations. Second, the WES wargame model, besides having no capability to simulate ground units, is felt by many to be very unwieldy and time-consuming to set up, and difficult to play. Expenditures of more than 40 man-hours to set up a scenario are not uncommon. Additionally, WES is resident at the Naval Ocean Systems Center (NOSC) in San Diego. In order to run the combined models, it is necessary to link two computers via the TELNET facility on the secure ACCAT network.

The prime objective of this thesis is to remedy the above-mentioned shortcomings. The first of the problems was solved by implementing the capability for up to six user-selectable communication channels between players; the communications model was also freed from dependence upon the WES model. It is now possible to utilize the communication model with any wargame. Additionally, an improved capability to gather message traffic statistics for post-game analysis was developed. Secondly, a new wargame, the McClintic Theater Model (MTM), developed at the Army War College, was imported and implemented on the VAX 11/780 located in the Computer Science Department at NPS. MTM, in addition to providing the capability to simulate ground, air and naval surface units, is also much simpler to manage and play than the WES model.

The final output of this thesis is a combined software model providing a capability for C3 experimentation in the areas of organizational relationships, communication networks and procedures, link and circuit analysis, and combat doctrine and tactics.

This document contains five appendices designed to assist a new player to understand and use the C3 Model. Appendix A includes generalized player and controller instructions for set-up and play, along with schematics of the model program flow. Appendix B consists of a checklist and suggested worksheets to be used by the controller to compile data for entry into the model. Appendix C is an example user/computer dialogue, followed by several sample message inputs and outputs. Appendix D contains a block diagram of C3 Model module and file organization; and Appendix E includes the C3 Model computer code, as well as code for a HELP facility for MTM.

II. GENERAL GAMING CONCEPTS

There are several ways to test and evaluate combat scenarios, doctrine, and C3 systems. Perhaps the most realistic method makes use of field exercises with troops performing simulated combat under battlefield conditions. Field exercises, however, have many drawbacks. Many months (or years) of planning and coordination are required in preparation for an exercise of any size. Besides being enormously expensive to stage, data collection (a secondary consideration for participants whose primary concern is generally training) and analysis are difficult and time-consuming. In addition, replication and sensitivity testing are virtually impossible to achieve.

An alternative to massive field exercises is the use of wargame simulations. Many relatively sophisticated board-type games are available today; PEGASUS, developed by the U.S. Army, is an example of this type. These games involve commanders maneuvering their "forces" on a grid map in accordance with game rules; movements and combat results must be computed and tabulated manually. Additional artificiality is present because the game is played in "turns", each team responding to the other team's last move. A sense of time criticality is difficult to achieve under these conditions. The usefulness of such games is generally limited to procedural training; they are virtually worthless as test and evaluation tools.

One step up from these board games are computer wargame simulations. These free the players from the clerical requirements involved with board games because movements and combat results are handled by the computer and effects reported to the players, who need only keep their displays current with the data base. The simulation is time rather than event-driven, and simultaneous inputs from both teams are possible. The fact that the combat algorithms within these games are generally stocnastic in nature requires considerable testing against historical data in order to refine parameters before the results can be truly credible. Replicability of a single set of results is virtually impossible, but a statistical average of results from a number of runs becomes meaningful. Sensitivity testing on input parameters is possible only after the internal algorithms and parameters have been refined and validated.

From a C3 point of view, the authors were aware of no computer wargame simulation capable of modeling a Command Control structure and less-than-perfect communication systems which such a structure must utilize for the transfer of information. During game play with some wargames, members of each team (Red or Blue) are typically located within the same room, sharing the same intelligence data and "view" of the battle. Problems of coordination among members of the command hierarchy and transmission of orders to lower level operational unit commanders are simplified to the point of triviality. Thus, these simulations fail to adequately reflect reality--commanders are often not collocated and may have different, sometimes conflicting, information. Real world commanders must rely on real world communications networks to share information, coordinate operations, and promulgate orders; and each of these activities is subject to degradation in the form of delay, garbling, loss, and errors of interpretation. It was toward developing a realistic model of these processes that the authors' efforts were directed.

III. COMBINED OBJECTIVES AND TASKS

The first task was to select a wargame on which it would be possible to overlay the proposed new C3 Model. Basic prerequisites for selection were:

1) ease of use and simplicity of set-up;

2) capability of simulating land, sea and air combat;

3) size compatible with current and/or projected mainframe computers at NPS.

The McClintic Theater Model met all of these requirements satisfactorily and the Army War College was willing to export this program to NPS. The second objective was to develop both MTM and the C3 Model for eventual implementation on a DEC VAX 11/780 computer to be installed in the Secure 'C3 Laboratory at some time in the future. Since the War College had plans for acquiring the same computer, the arrangement was felt to be mutually beneficial.

Since the size of MTM exceeded the CPU capacity of the computer currently installed in the C3 Lab, and, at the time MTM was received, the VAX had not yet been installed in the Computer Science Lab, the first implementation effort for the wargame was on the NPS IBM 3033 computer. This meant that almost every line of code (6000 lines) needed to be changed to convert the original Honeywell Fortran to IBM

Fortran. The conversion required over a month to complete, followed by several weeks to solve system interface problems due to differences in capabilities of the computers. However, an excellent understanding of the MTM algorithms was achieved during the conversion, which led to an expedited transfer to the VAX 780.

The third objective was to implement MTM on the VAX 780, build a workable Fortran communication model, and integrate the two. Care was taken to make only those changes to MTM which were required to accommodate characteristic differences between Fortran versions. The transfer of MTM proceeded smoothly and the VAX proved to be well-suited for the combined models.

Using the Stack-Secorsky model as a starting point, the C3 Model was developed on the VAX using Digital Control Language (DCL). DCL is a high level language feature of the VAX/VMS operating system which facilitates the writing of interactive programs that operate very close to the system level.

The direct translation of the Stack/Secorsky algorithms (written in the "C" programming language) to Fortran was considered unsatisfactory because they did not provide all the desired features and lacked the needed flexibility. A new Fortran message handler was therefore written to simulate:

1) delays based on MTM battle factor (ratio of battle time to real time),

2) lost messages, and

3) message garbling.

An additional feature built into the message handler was the ability to operate virtually independent of a particular wargame. The only changes required to use it with a different game are those required because of different file names and access methods.

The final objective was to integrate the new communication model with MTM, to ensure software and procedural compatibility, and to demonstrate the full combined capabilities of the two models for evaluation of C3 characteristics. Since the integration requirements were designed into the message handler, the actual integration of the models was relatively simple.

In the combined model there are three levels of communication participants: those who will be communicating directly with the MTM wargame, those who are part of the command hierarchy, and the overall game controller (umpire). The one player on each team who interfaces directly with MTM is also a part of the command and communication structure in that he receives orders from commanders and inputs them into the game. All other Red or Blue players participate only by sending and receiving messages via the C3 Model and can neither input orders nor receive MTM outputs directly.

On-line documentation in the form of a HELP facility was added to assist users in entering commands into both the C3 Model and into the wargame. A total of thirteen VAX directories are available for play--ten for players at the C3 Model level and one each for the Red and Blue game players plus one for the game controller. More directories may easily be added as needs grow and additional terminals become available.

IV. COMMUNICATIONS MODEL CAPABILITIES

The command structure and communication links (circuits) to be used during a game are defined by the game controller prior to game start. (Specific instructions are contained in Appendix A.) The controller specifies player game names and associated VAX directory names as well as the communication circuits (up to six) available between each player pair. In addition, the following link characteristics are defined for each link type:

1. Message arrival and service rates to be used in the delay (queuing) algorithm. Standard or controller-determined rates may be used.
2. Probability of message garbling.
3. Message character garbling rate.
4. Message loss rate.

It is possible to change these characteristics as well as the available circuits during game play. Players may also be removed, temporarily or permanently, to simulate communication circuit failure and restoration.

The algorithm to determine message delay times is basically that used by the Stack-Secorsky model.

> "The queuing time represents the amount of time a message will be delayed in arriving at its destination and is calculated from the single-server queuing theory equation:
>
> $$WQ = A/(S(S-A)) \quad \text{where}$$

WQ is the average queuing time;
A is the average message arrival rate;
S is the average message service rate.

Unscheduled arrival rates for messages are viewed as conforming to a Poisson distribution and the inter-arrival times between these message as following a negative exponential distribution. During game play the program transforms a uniformly distributed random number (y) to an exponentially distributed random number (x) using the relationship:

$$x = (-1/L)\ln(y)$$

where L is the average message arrival rate specified by the experimenter. ...The arrival [times] for unscheduled arrivals [are described by] the following relationships:

$$f(y) = Ae^{-Ay}$$

$$\text{Expected value}[y] = 1/A \text{ and } \text{Variance}[y] = 1/A$$

where A is the mean of the message arrival [time]. The service time is also negative exponentially distributed with a mean of 1/S where S is the average service rate. For the above equations to hold, an infinite population of messages must be assured. It is also necessary that the ratio A/S be less than 1 or the queue and the waiting times will increase without bound." [Ref.1]

Since computed delay times are based on the system (computer) clock, and the MTM game time factor is capable of being varied by the controller during game play, this computed time is adjusted to reflect the current ratio of battle time to real time being used.

Message loss and garbling are determined by use of a pseudo-random number generator within the message handler and are based on a strict comparison with the probabilities and rates specified by the controller. Garbling is performed on a character-by-character basis.

As soon as a message is sent by a player, an undelayed and unadulterated copy is sent to the controller's directory. Additionally, the controller receives one copy of each message as it is received by each addressee. This message copy also contains statistics which show the results of the random number comparisons mentioned above as well as the actual delay time. These message copies are stored in the controller's file for post-game analysis.

Some concessions must be made to play the combined game in its present implementation due to the numbers and locations of VAX terminals. Red players are all collocated in the same room, and are not players in the communications model. Red interfaces only with the MTM game through a hard-copy Miniterm via a telephone link to the VAX. Blue players are all collocated in a different room, with the various commanders utilizing six VT-100 terminals for passing message traffic among themselves and orders to the Blue player interfacing with MTM. This Blue player is also linked to the VAX through a hard-copy Miniterm via phone link.

It is realized that these conditions are less than ideal for several reasons. First, a certain degree of artificiality is introduced by requiring collocated Blue players to communicate by message traffic rather than verbally. Second, each player shares a common view of the battle with all his teammates. Ideally, players should be broken up into logical groups representing command and staff elements, each with its own game board and each capable of communicating with other team elements as well as interfacing with MTM. An example would be several elements of Red and Blue staffs at the Army War College, Air War College and NPS playing the combined game via ARPANET. Only minor modifications to the C3 Model should be necessary to accommodate this mode of play.

V. WARGAMING CAPABILITIES

A. MCCLINTIC THEATER MODEL

During the design of the McClintic Theater Model, an area of primary concern was keeping the game play simple so that it could be easily used by players lacking in computer experience. This was accomplished by using free-form keyword inputs. Thus, alignment and spacing are unimportant when entering orders. Because keyword searching is used, the order of input is also unimportant and the computer will ignore words that it doesn't recognize rather than considering them to be errors. This allows an almost English-like interface dialogue, and the player can spend more time using the model and less time learning to use it.

Each input is checked for validity before action is attempted by the model. If an invalid order is entered, it is ignored and an error message is printed immediately. Such errors as moving enemy units, firing beyond an artillery's range, moving a unit that is out of POL or initiating a nuclear or chemical strike without controller permission are prevented by this feature. However, tactical blunders such as attacking friendly units or stumbling into one's own mine fields are permitted.

The model is based on a variable-size hexagonal grid network which is applicable to any part of the world. A small interactive data generation program is used to define a new scenario. A new data file can be created in a day or less (after data collection) by simply answering questions asked by the program.

The program is modular in structure and is organized as depicted in Fig 1. Each block is a separate subroutine within the program, simplifying algorithm changes to more accurately reflect reality or to examine specific functions in more detail. Parameters within the data base or the modules can easily be changed by the controller during game play by entering the CONTROL subroutine. The game is time driven vice event driven to improve realism. Status reports on units and logistics are available upon demand, while intelligence reports are generated at specified intervals or upon request.

MTM was designed to serve as an evaluation model for Corps commanders in evaluating and modifying strategies and tactics in the Tactical Command Readiness Program and to aid in the training of senior officers at the Army War College. The game is a high level game for division and larger size forces and thus some generalizations were required in the details of combat and other factors applicable to forces of this size. The MTM algorithms are not detailed enough to permit evaluation of the micro elements of battle. However, the model does take into account virtually every macro aspect of battle and does a reasonable job of integrating all of the elements together into a single model. MTM

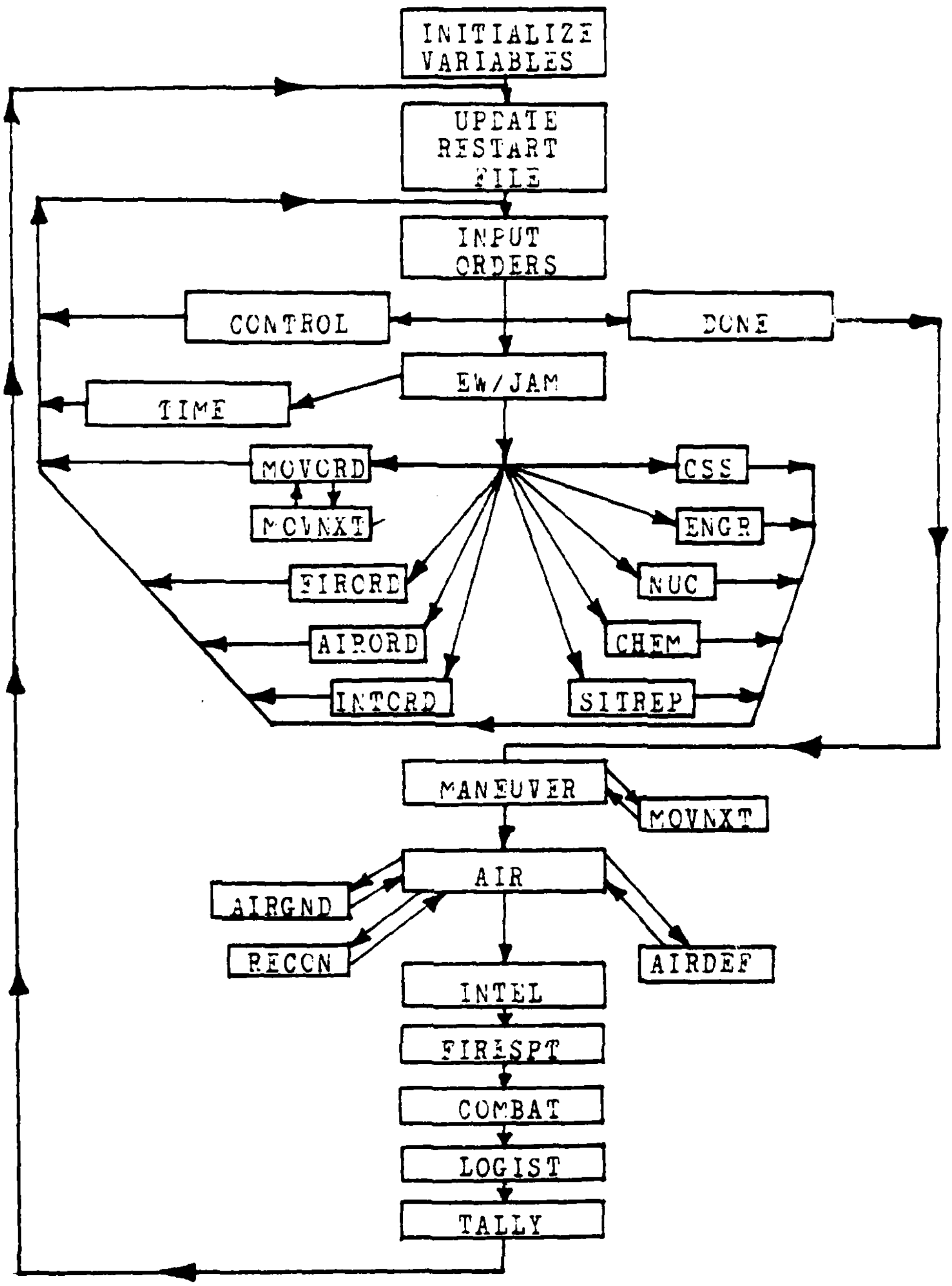


FIGURE 1

MTM SUBROUTINE ORGANIZATION

models Red and Blue forces equally well with all features available to both sides.

MTM is capable of modeling any sized combat unit from a single ship or aircraft up to a fleet or a wing of aircraft. Attack and tactical aircraft, as well as utility and transport aircraft and helicopters, are permitted. Naval units can also sea-lift ground units and supplies. Ground units are limited to division and battalion size for practical reasons, since only 300 units can be modeled at a time. The model also has a restart capability to allow the user to recover if there is a computer system failure or play is extended over several days.

Movement of ground and sea units is permitted up to and including the maximum allowable speed set for that unit. Ground unit movement is negatively affected by terrain and barriers such as mountains, forests, cities, rivers, bridged rivers, anti-tank ditches and minefields. Roads act positively by increasing movement speed. Actual routing is computed to take the shortest, quickest and safest track through the terrain and barriers.

The model handles the placement and clearing of minefields, air defense artillery, artillery, air-to-air combat, twelve classes of supplies and electronic warfare. Nuclear, chemical and biological, as well as conventional, attacks are available, but permission is required from the game controller for either team to exercise these options.

B. ADAPTATION

As mentioned above, the structure of MTM has been preserved as much as possible. The changes that have been made were generally to accommodate Fortran version differences. All of the original MTM subroutines, functions and variables have been retained and, from the user's standpoint, the version being run at the Army War College and the version at NPS are identical.

One feature which has been added to the combined models has been the inclusion of MTM Volume II (Users Manual) on-line as a HELP facility. By entering the word "HELP", the Red or Blue player will be shown a menu of allowable MTM commands. By then entering the name of one of these commands, he will be shown either an abbreviated (format only) or verbose description of that command. This feature should help reduce training/familiarization time.

There are two MTM subroutines which have been suppressed in the current NPS implementation. The first of these is the TALLY subroutine which gathers controller-specified game statistics as a function of time. The statistics are then displayable via the graphics capabilities provided with MTM. TALLY is not used because no compatible graphics terminals were immediately available during implementation efforts at NPS and, perhaps more importantly, the statistics-gathering appeared to slow down game processing on the VAX, particularly when high battle time factors were being used and other users were sharing the CPU. This omission is not a significant drawback at this point because the game is serving primarily as a framework for C3 experimentation.

The second suppressed subroutine--LOGISTICS--does have a major impact on communications experimentation. This subroutine is not used because the additional players which would be required to handle resupply, airlift and sealift problems exceeds the number of terminals available. Thus, a major portion of the message traffic which would normally be stressing the communications circuits does not occur. This is the one major shortcoming in the present implementation of the combined models.

VI. CAPABILITIES DEMONSTRATION

A relatively informal wargame utilizing the combined models was conducted on March 12, 1982 for the purpose of demonstrating the capabilities of both MTM and the C3 Model. Participants in this wargame included professors from the Operations Research, Electrical Engineering and C3 curricula; systems specialists from the Computer Science Department; and contractor representatives from Jet Propulsion Laboratory, who will eventually be responsible for software maintenance in the Secure C3 Laboratory.

A. SCENARIO

The game scenario involved a simulated invasion of Central Europe by Warsaw Pact forces. The invasion force included 89 tank, motorized rifle and infantry divisions and 21 air wings. Defending were NATO forces which included 65 infantry, armor and mechanized divisions; airborne brigades and air calvalry regiments; and 16 air wings.

Initial force dispositons were in accordance with the standard MTM NATO unclassified data base. Major PACT force concentrations and points of attack occurred at the Fulda, Cheb and Highway 12 Gaps. The mission of the Blue force was to delay the advance of the invading force as long as possible to allow for the arrival of U.S. and other NATO reinforcements.

B. COMMAND/COMMUNICATIONS STRUCTURE

The Blue command structure modeled for the demonstration is shown by the portion of Figure 2 outlined by the dashed line. The air and ground units under the operational control of NORTHAG, CENTAG, 2ATAF and 4ATAF were assigned arbitrarily using the center line of the playing board as the dividing line. The Red team consisted of only two players and was located in a separate room with its own display board.

Initially each Blue player was given a complete communication capability of all six possible circuit types with all other Blue players. Circuit traffic loading was set to "normal" at the start of the game and increased to "heavy" as play progressed. The intitial circuit parameters, as well as sample message inputs and outputs are included in Appendix C. These parameters as well as the availability of circuits between player pairs, were degraded over time to reflect combat effects on communications.

C. RESULTS

An initial briefing was followed by a period of user familiarizaton and experimentation with the C3 Model constructs, MTM orders and the VT-100 terminals. After this familiarization period, the Blue players appeared to begin to feel comfortable with combined model play. (It seems to take approximately two to three hours of fairly concentrated

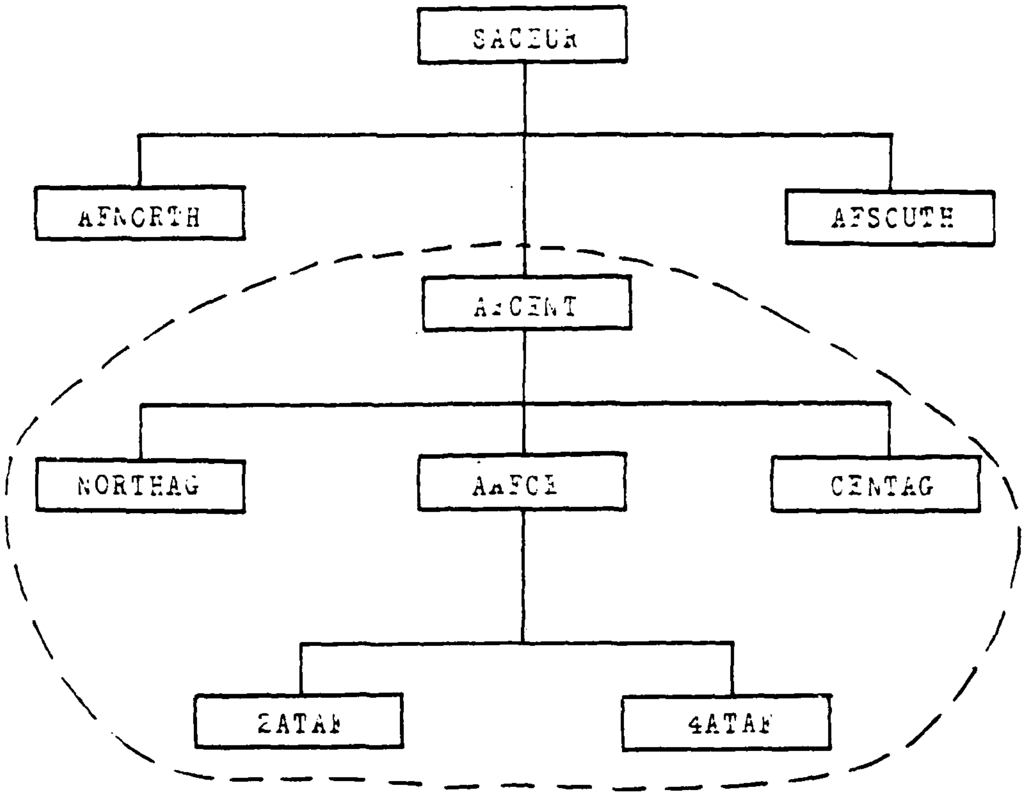


FIGURE 2

COMMAND CONFIGURATION (DEMC)

play for a user to reach this point.) There were two problem areas which surfaced during the demonstration.

The first of these problems related to the implementation of the models on the VAX. When the demonstration began, another user had two long-term processes running on the system batch queue, which had only a four-job capacity. Since the C3 Model uses the same batch queue to store messages which have been processed by the message handler but are awaiting expiration of the computed delay period, this meant that only two pending messages could exist at any one time. Additional messages were rejected by the queue and discarded. This problem was solved during the demonstration by the creation of a new batch queue dedicated to the C3 Model message handler. The new queue has a capacity of 50 pending messages and the capacity can easily be increased by a system operator if required.

A second problem developed during the familiarization period when the players began to focus their attention on the MTM game to the exclusion of the communications model; coordination and planning were performed by direct verbal communications among players, thus bypassing the communications portion of the game. This problem was not totally unexpected and was a result of all Blue players being collocated, with only one game board among them. The problem could have been alleviated to some degree by requiring inputs from various commanders to the Blue player interfacing with MTM to take the form of messages via the C3 Model, rather than using preformatted order forms.

As a result of this demonstration, it is apparent that, while the combined model functions basically as desired, it will be difficult to use for experimentation in the mode of play used for the demonstration; maintaining artificial barriers to communication is virtually impossible. The usefulness of the model will be realized only after computer terminal availability allows Blue and/or Red team members to play on a physically separated, distributed network basis. (See Section F of Chapter VIII.)

VII. CONCLUSION

The authors feel that, by and large, the goals which were established when this thesis was first discussed have been achieved. A new and easier-to-play (than WES) wargame is now fully functional on both the IBM 3033 and the DEC VAX11/780. Sufficient game materials have been procured to support a two-sided (NATO vs. Warsaw Pact) game using the Central European data base. Another unclassified MTM data base is currently available for Southwest Asia as well as a classified NATO data base; it is only necessary to acquire the associated maps, overlays, and game pieces to exercise scenarios in these arenas.

The C3 Model developed as part of this thesis provides a flexible and adaptable tool for C3 experimentation and analysis. Virtually any command structure and its associated communications network can be modeled for experimentation, subject to hardware limitations. Within the communications model, circuit parameters may be adjusted to simulate any possible combination of circuit types. While only six circuits are included between players in this initial version of the model, it would be a simple matter to increase this number to 256--the limiting factor being the controller's ability to effectively manage this number of links (See Chapter VIII).

The one initial objective which was not met due to time constraints was to completely validate model performance and perform experimentation and analysis using the combined models. Validation is a critical step in any model development and must be performed prior to any serious experimentation.

The authors strongly recommend that a close working relationship be established and maintained between NPS and the Army War College to assure configuration control of the MTM game; this area has long been a problem with the WES model. It is also strongly urged that the Army War College expedite publication of Volume IV (Software Description) of the MTM Manual. This volume is critical if programmers are to be thoroughly familiar with the algorithms and be able to suggest improvements to the game.

VIII. RECOMMENDATIONS FOR FURTHER WORK

The work done in this thesis should be viewed as only a beginning and not as project that has been or will ever be completed. An experimenter now has a tool needed to begin to build the data base for analysis. The following areas, however, require additional development and testing.

A. CIRCUIT PARAMETERS

The circuit parameters used in the current C3 Model are estimates only and are not based on actual communications circuit data. Actual circuit parameters are available from the service communications commands on circuit qualities for various types of circuits. Qualities are typically expressed as error rates, average message delivery times under different load conditions (messages per hour) and message retransmission rates, which loosely convert to lost message rates. With this information in hand, different circuit configurations should be catalogued for use in game analysis and then tested under varying game conditions to determine circuit sensitivity to extremes of loading and parameter variation.

B. COMMAND STRUCTURES

Wiring diagrams are also needed to show how command structures are tied together and organized for Tactical and Strategic C2. Determining how commands are organized for C2 may be a very difficult undertaking. Peacetime and wartime configurations are often very different, yet both must be understood and modeled if improvements are to be made. Once this has been accomplished, the communications links should be overlayed onto the command structure to represent the C3 configurations. With the circuit parameters and command structures, the C3 model can be loaded to represent actual C3 systems with their inherent advantages and faults.

C. PCST GAME ANALYSIS

A post-game analysis feature is needed for the C3 model. Messages and individual message data are collected by the model software, but no provisions have been made to collect the cumulative message data and to do any on-line data analysis. The information is already available with the current model (delay times, percent garbling, lost message values, circuit numbers, etc.) so that, as each message is sent, data could be extracted and stored. Once the data is stored, it could easily be called up and game statistics calculated, freeing the experimenter from a lengthy post game data reduction. A methodology for combining all available measures of effectiveness into a single Effectiveness Index should be developed to allow comparisons between configurations.

D. GRAPHICS

The MTM wargame model needs a graphics package which provides more display capability than the current version. Commanders need to see views of the battlefield with differing degrees of resolution. The graphics capabilities exist at NPS to achieve this capability, both in hardware and software development support.

E. LINK MANAGEMENT

As mentioned in the previous chapter, the capability to specify up to 256 circuits between players is a relatively simple matter to implement in software. More than six circuits between players will be required if the model is to simulate complicated switched networks realistically. However, procedures and/or software must be developed to enable the controller to manage this number of circuits effectively.

F. MTM INTERFACE

As implemented on the VAX, the combined model allows only one Red, one Blue and one Controller to be interfacing with MTM at any time. All orders from each team must thus be "funneled" through this single input point to MTM. Besides an almost unmanageable workload on this player during periods of intense play, the inability of a commander to order his forces directly contributes significantly to a sense of artificiality.

The original implementation on the IBM 3033 allowed for multiple points of interface with MTM on each side. MTM responses to orders were channeled to the player from which the input was received. In effect, this allowed independence among commanders and would allow the game to be played in a distributed mode. The VAX version of MTM did not contain this feature due to time constraints. Addition of the player distribution feature should be among the first priorities for further work on the combined model.

G. IMPROVED CIRCUIT MODELING

It is desirable to have the capability to simulate packet-switched circuits with multiple nodes, such as JTIDS. Provision for node deletion and automatic message forwarding should be included.

APPENDIX A

USER INSTRUCTIONS

A. GENERAL

A total of 14 VAX directories are currently dedicated to the C3 Model; names are as shown in Figure 3. The CLARK directory contains the entire model, including MTM; it also collects copies of message traffic during game play. (Controller: See Note 1.) Figures 3 through 8 of this appendix are schematic representations of the C3 Model and depict how a player or controller moves about among various sections of the model by using the various commands shown between brackets(< >).

B. CONTROLLER PREPARATION

Prior to the start of play, a controller must log onto the computer and enter the BUILD/MODIFY section of the model in order to define the command structure and communication network to be used for the game. Data preparation worksheets and general instructions for this purpose are provided in Appendix B. A controller who is unfamiliar with these procedures will find Figures 3 and 5 in Appendix A helpful. The BUILD/MODIFY portion of the model is interactive: the controller need only respond with menu selections and values as requested by the program. Parameters entered in this section of the model are stored in various files of the CLARK directory for use during play (see Appendix D). MTM startup is also done from this section using INITIALIZE.

Passwords are requested at various points in the program for entry into certain parts of the model. A copy of this thesis with passwords annotated on Figures 3 and 5 will be available for qualified controllers in the C3 Curricular Office.

The data base which MTM uses is named [CLARK]WARDAT.DAT. This file is read by the game upon initialization and is periodically updated during play. It is this feature which allows MTM to be stopped at any time and resumed at that same point later. If it is desired to start a new game from time zero, the appropriate data file, either standard (NATO=NATO000.DAT, IRAN=SWA0000.DAT.) or built/modified using the DATA section of INITIATE, must be copied into [CLARK]WARDAT.DAT prior to initializing MTM. Creating a new data base or making changes to an existing data base is done interactively by appropriately responding to the questions asked by the program.

C. PLAYER INSTRUCTIONS

The schematics shown in Figures 4, 5 and 8 of this appendix are applicable to game players. Game names and associated directories, as well as directory and game passwords, must be provided by the controller prior to play.

Once logged into the appropriate directory on a VT-100 terminal, entry of "C3MODEL" gives access to the game.

Once in the model, the program will ask for two passwords. Red, Blue and MTM Controller will enter the MTM password when requested. All other players enter a carriage return <CR>. All players enter only a carriage return when asked for the controller password. At this point, the program will branch each player to the appropriate point in the program. A list of valid commands (except for MTM Controller) is available by typing "HELP". A description of controller commands is available in the MTM Manual, Volume III (Controller).

There are two idiosyncrasies of the VAX which must be discussed. When MAIL is commanded, the program branches to the system mailer (prompt = MAIL>) and previously unexamined messages may be viewed sequentially by depressing RETURN. Exit from this mode is accomplished by typing "EX" followed by a RETURN. When SENDMSG is commanded, entries are made into a preformatted message header (TO:, FROM:, SUBJECT:) followed by a request for a circuit type over which the traffic is to be sent. At this point, the system text editor is invoked and the message text entered by the player. Once text entry is completed, depress PF1 followed by 7 on the numeric keypad. This will cause "COMMAND:" to appear at the bottom of the screen. Typing "EX" followed by the ENTER key on the keypad exits the editor. The message will be automatically sent and the program will branch back to the command level. If "QUIT" is used instead of "EX", the latest previously sent message will be forwarded to the current addressees.

D. DATA ANALYSIS FILE

Message copies are collected during play and stored in [CLARK]MAIL.MAI. This file may be reviewed for both post-game analysis as well as during play to immediately assess the impact of changes to communication circuits and parameters.

Note 1: Because execution of the MTM portion of the model will halt if the disk quota of the directory from which MTM was initiated is exceeded, it is recommended that the CLARK directory not be used (logged into) for active play. If MTM execution halts for this reason (a printout describing the cause of the halt is provided in the main computer room each time execution stops), the offending directory must be purged and MTM restarted.

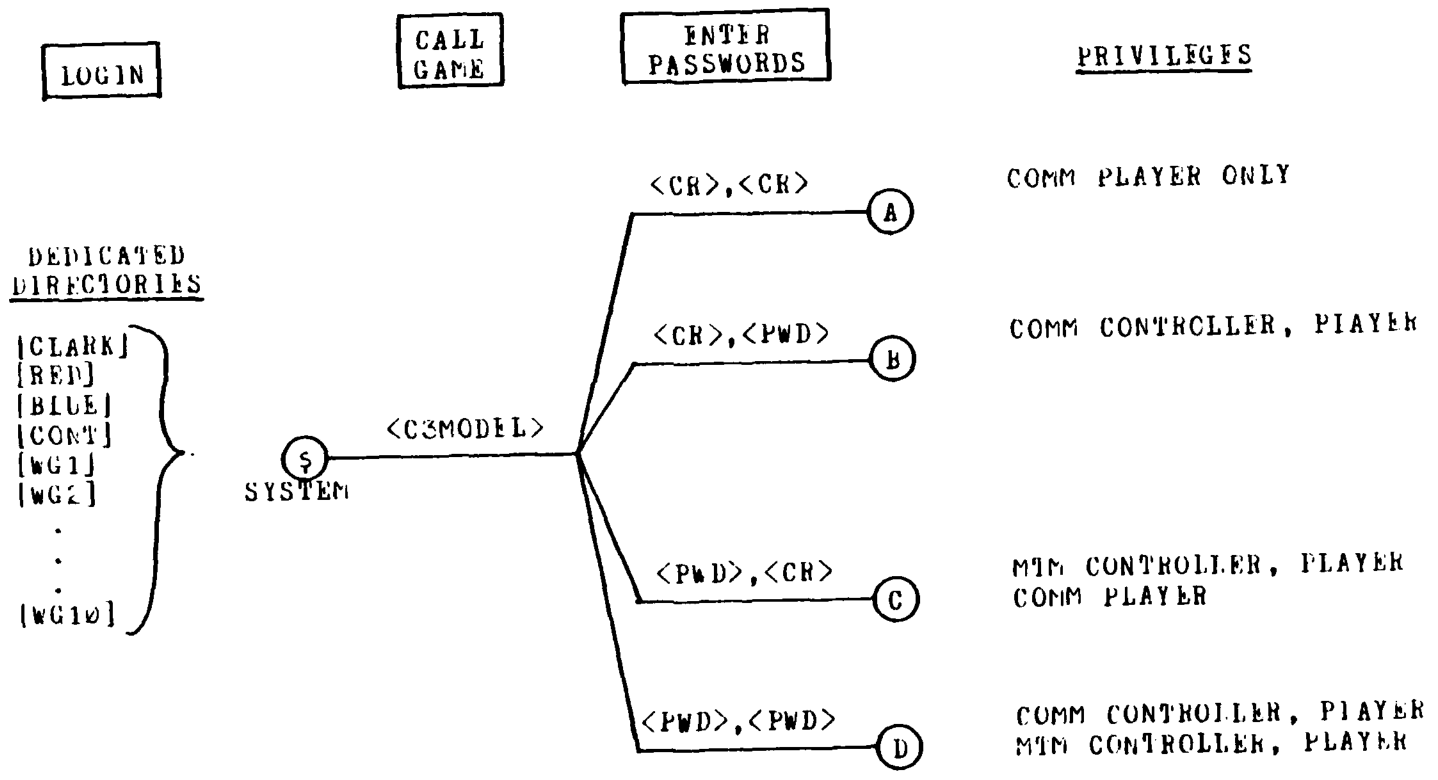


FIGURE 3

C3 MODEL USER SCHEMATIC (PART 1)

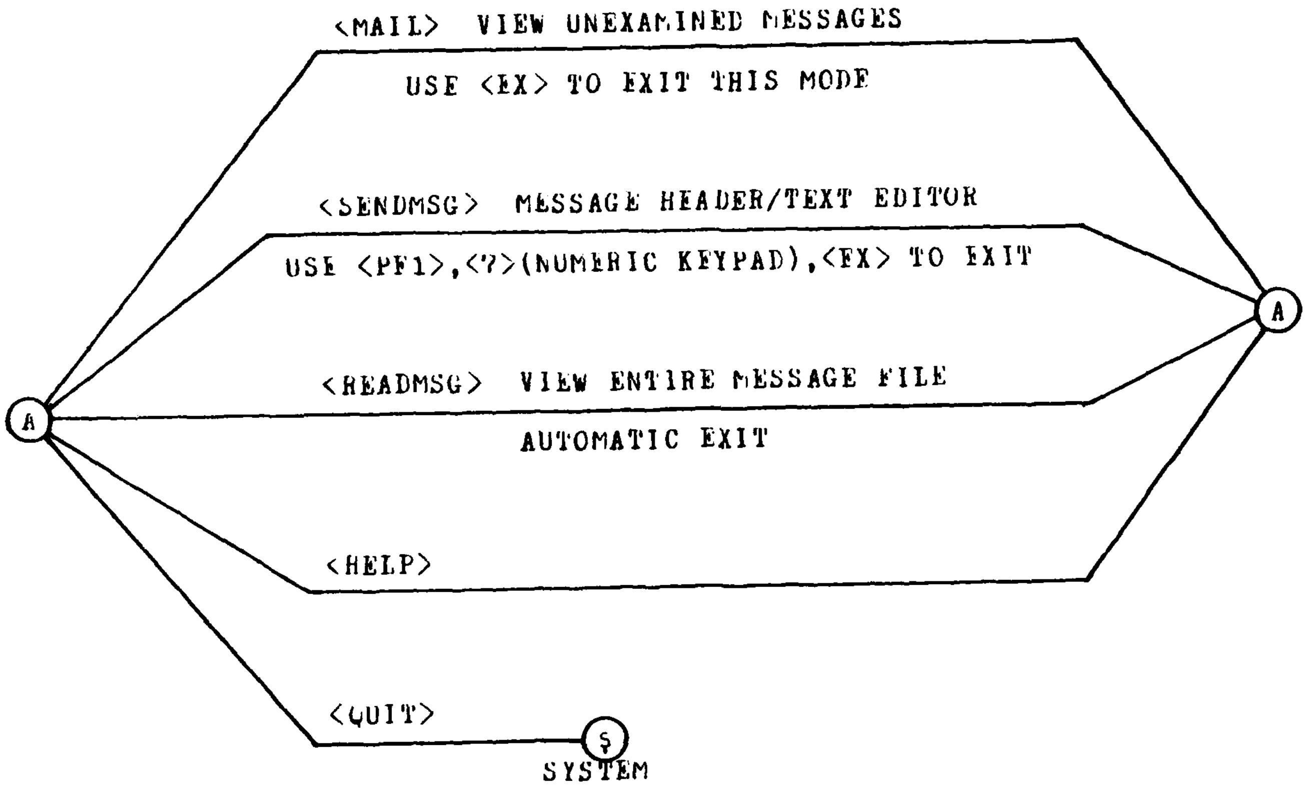

<MAIL> VIEW UNEXAMINED MESSAGES
USE <EX> TO EXIT THIS MODE
<SENDMSG> MESSAGE HEADER/TEXT EDITOR
USE <PF1>,<7>(NUMERIC KEYPAD),<EX> TO EXIT
<READMSG> VIEW ENTIRE MESSAGE FILE
AUTOMATIC EXIT
<HELP>
<QUIT>
A
A
$
SYSTEM

FIGURE 4

C3 MODEL USER SCHEMATIC (PART 2)

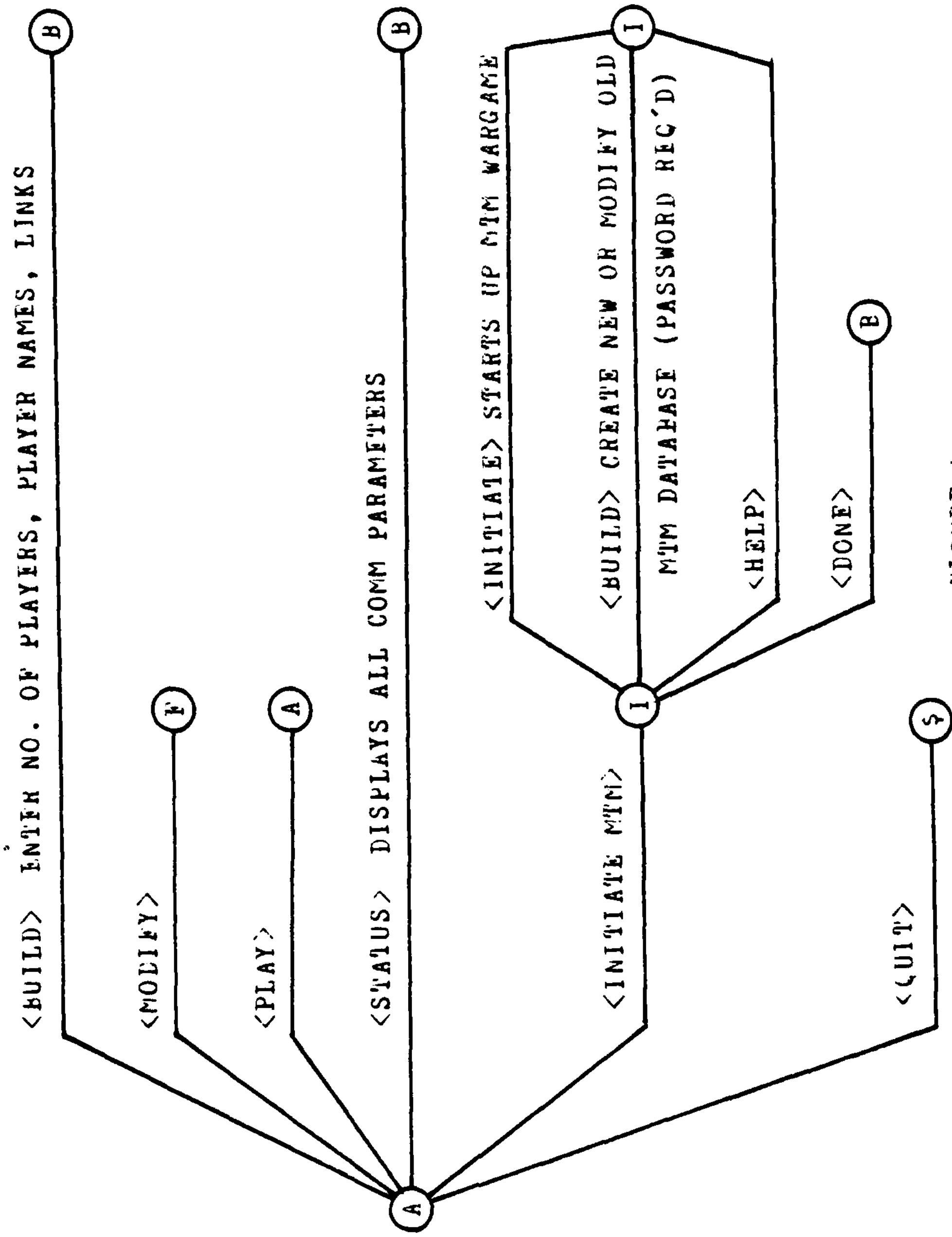
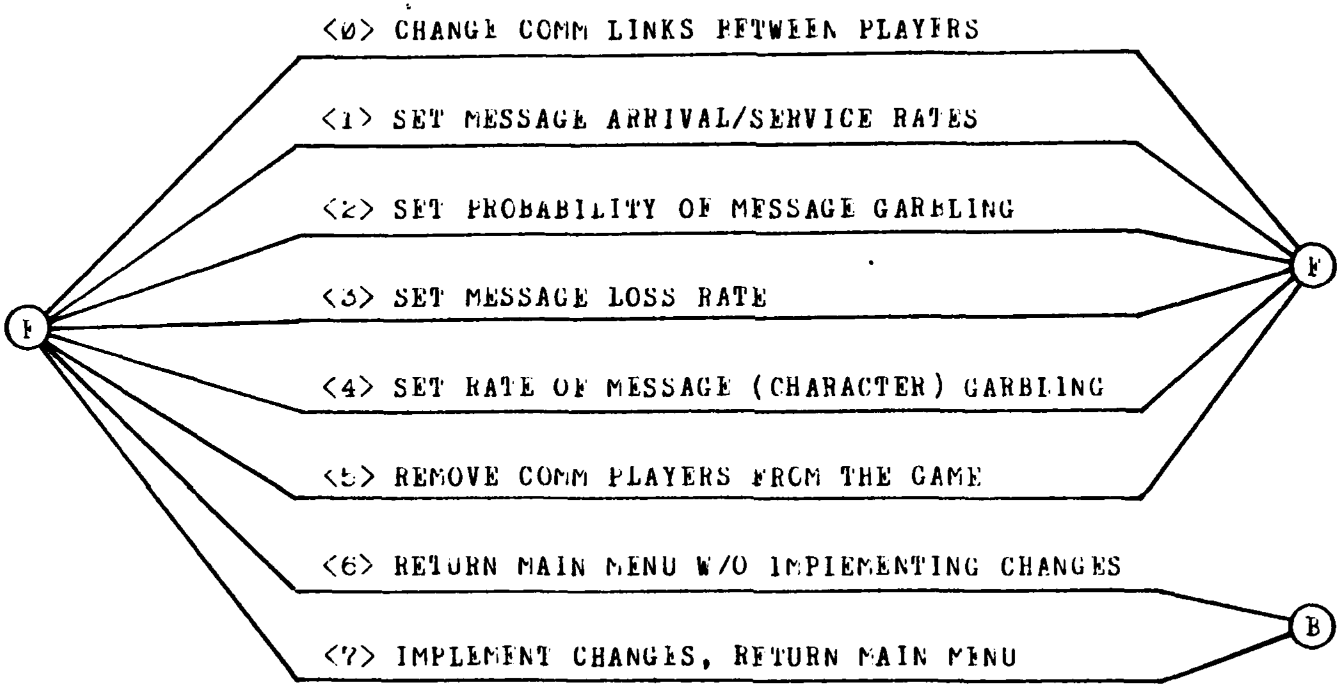

A
<BUILD> ENTER NO. OF PLAYERS, PLAYER NAMES, LINKS
B
<MODIFY>
F
<PLAY>
A
<STATUS> DISPLAYS ALL COMM PARAMETERS
B
<INITIATE MTM>
I
<INITIATE> STARTS UP MTM WARGAME
<BUILD> CREATE NEW OR MODIFY OLD MTM DATABASE (PASSWORD REC'D)
<HELP>
I
<DONE>
B
<QUIT>
$

FIGURE 5

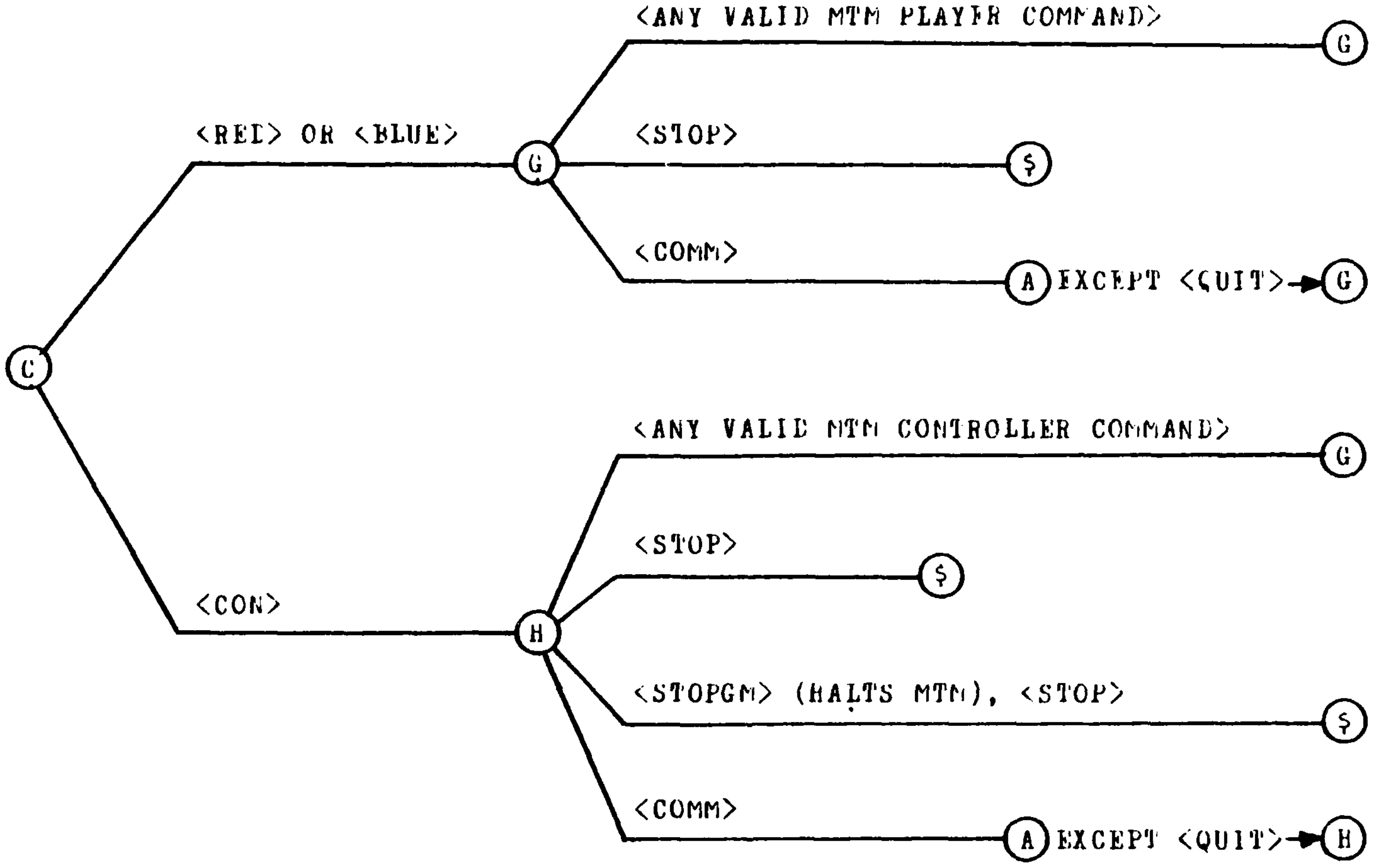
C3 MODEL USER SCHEMATIC (PART 3)



F
<0> CHANGE COMM LINKS BETWEEN PLAYERS
<1> SET MESSAGE ARRIVAL/SERVICE RATES
<2> SET PROBABILITY OF MESSAGE GARBLING
<3> SET MESSAGE LOSS RATE
<4> SET RATE OF MESSAGE (CHARACTER) GARBLING
<5> REMOVE COMM PLAYERS FROM THE GAME
<6> RETURN MAIN MENU W/O IMPLEMENTING CHANGES
<7> IMPLEMENT CHANGES, RETURN MAIN MENU
F
B

FIGURE 6

C3 MODEL USER SCHEMATIC (PART 4)



<RED> OR <BLUE>
<CON>
C
G
H
<ANY VALID MTM PLAYER COMMAND>
<STOP>
<COMM>
<ANY VALID MTM CONTROLLER COMMAND>
<STOP>
<STOPGM> (HALTS MTM), <STOP>
<COMM>
G
$
A
EXCEPT <QUIT>
G
G
$
$
A
EXCEPT <QUIT>
H

FIGURE 7

C3 MODEL USER SCHEMATIC (PART 5)

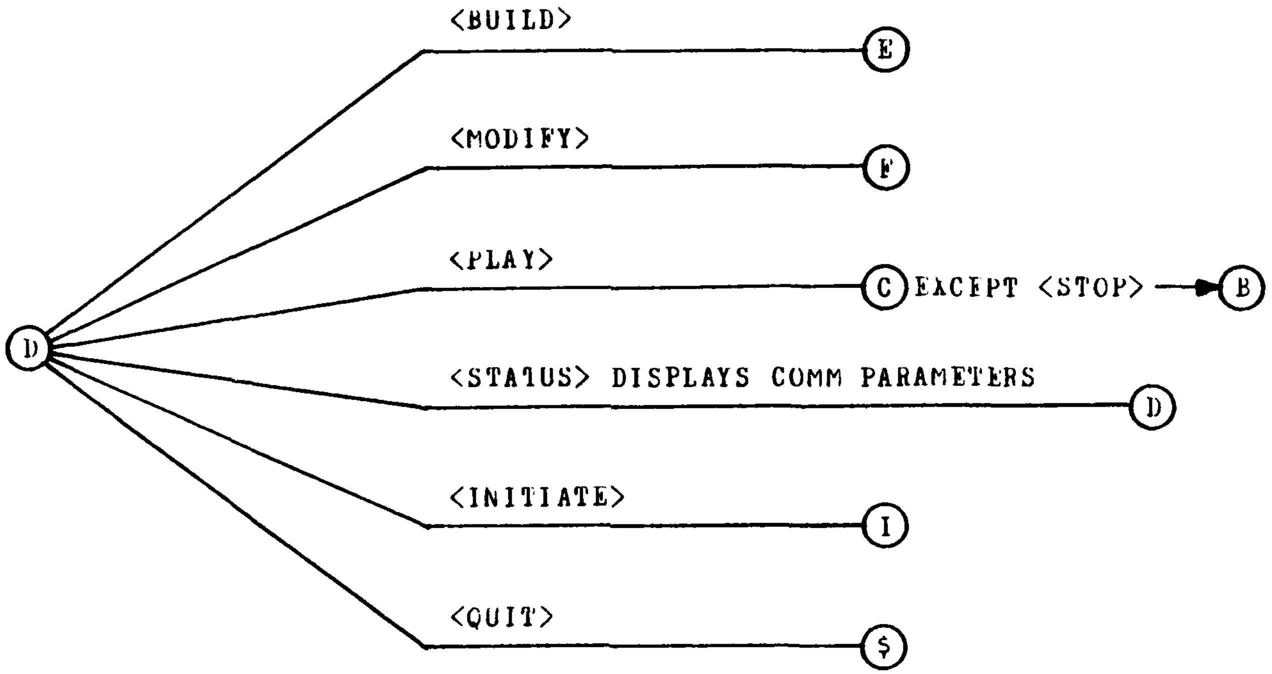


FIGURE 8

C3 MODEL USER SCHEMATIC (PART 6)

APPENDIX B

C3 MODEL

CONTROLLER CHECKLIST

I. COMMUNICATIONS:

STEP 1:

DESCRIBE THE BASIC COMMUNICATIONS PATHS BETWEEN UNITS, WORKSHEET 1.

STEP 2:

ENTER CIRCUIT CHARACTERISTICS IN WORKSHEET 2A.

STEP 3:

ENTER RESERVE AND/OR REMOVED PLAYER DATA IN WORKSHEET 2B.

STEP 4:

YOU NOW HAVE ALL THE NECESSARY DATA TO BUILD THE C3 MODEL.

LOG INTO ONE OF THE GAME DIRECTORIES AND ISSUE THE COMMAND "C3MODEL".

STEP 5:

DISREGARD THE MTM GAME PASSWORD, ENTER <CR>.

HOWEVER, DO ENTER THE CONTROLLER'S PASSWORD WHEN PROMPTED: "ENTER <CR> TO CONTINUE".

SELECT THE BUILD (B) PORTION OF THE C3 MODEL AND ENTER DATA FROM WORKSHEET 1.

STEP 6:

SELECT THE MODIFY (M) PORTION OF THE C3 MODEL AND ENTER THE DATA FROM WORKSHEETS 2A AND 2B AS IT CORRESPONDS TO ITEMS 1 THROUGH 5.

REMEMBER: EXECUTE ITEM #7 WHEN FINISHED WITH MODIFY.

YOU ARE NOW READY TO USE THE C3 MODEL.

BASIC COMMUNICATIONS PATHS

WORKSHEET 1

TOTAL NUMBER OF PLAYERS (INCLUDING CONTROLLER): _______

PLAYER NAME FROM/TO	CONTROLLER	PLAYER1	PLAYER2	PLAYER3	- - -
CONTROLLER	XXXXXX	101100	111000	000110	
PLAYER 1	101100	XXXXXX	001110	000111	
PLAYER 2			XXXXXX		
PLAYER 3				XXXXXX	

NOTE: XXXXXX REPRESENTS NO ENTRY

ENTER A SIX DIGIT NUMBER CONSISTING OF Ø'S AND 1'S TO INDICATE CIRCUIT AVAILABILITY BETWEEN PLAYER PAIRS IN THE POSITIONAL ORDER SHOWN SHOWN BELOW. (I.E. 1ØØØ1Ø REPRESENTS AN ENCRYPTED LINE AND A VOICE CIRCUIT)

1 -- ENCRYPTED LANDLINE

2 -- NON-ENCRYPTED LANDLINE

3 -- DIGITAL RF WITH ANTI-JAM

4 -- ANALOG RF WITHOUT ANTI-JAM

5 -- VOICE

6 -- PERFECT LINK

CIRCUIT PARAMETERS/PLAYER STATUS

WORKSHEET 2

A. CIRCUIT PARAMETERS.

CIRCUIT	1	2	3	4	5
ARRIVAL RATE					
SERVICE RATE					
PROBABILITY MESSAGE GARBLED					
LOSS RATE					
GARBLE RATE					

B. PLAYERS HELD IN RESERVE OR REMOVED FROM GAME

NUMBER OF RESERVED/REMOVED PLAYERS: ______

RESERVED/REMOVED PLAYER NAMES.

1.

2.

3.

4.

etc.

APPENDIX C

DIALOGUE AND SAMPLE OUTPUTS

This appendix is divided into two sections. Section A is part of the dialogue which took place between the computer and a user (player or controller) when the demonstration scenario data was entered into the C3 Model; inputs are shown within brackets (< >). Note that not all sections of the C3 Model are entered in this dialogue, but only those needed to support the scenario structure. Entry into other areas of the C3 Model is relatively simple using the program prompting (requests for inputs) and the instructions contained in Appendix A. Section B contains some of the actual input messages and the resulting outputs of the C3 Model during the game.

A. USER DIALOGUE

```
<C3MODEL>

          WELCOME TO THE NAVAL POSTGRADUATE SCHOOL C3 WARGAME

   THIS GAME IS THE RESULT OF A THESIS FOR THE C-3 CURRICULUM
BY CAPTAIN LLOYD CLARK, CAPTAIN LARRY PLESS AND MAJOR BOB RAPP.

IT REPRESENTS AN IMPROVED ADAPTATION OF A STRUCTURED COMMUNICATIONS
MODEL FIRST DEVELOPED BY LT COL TOM STACK AND LCDR TOM SECORSKY.

THE WARGAME ITSELF IS THE MCCLINTIC THEATER MODEL (MTM) DEVELOPED
AT THE US ARMY WAR COLLEGE.

            ********************************

MTM PLAYERS ENTER GAME PASSWORD. (ENTER <CR> IF UNKNOWN):   <CR>

CONTROLLER ENTER PASSWORD (ENTER <CR> IF UNKNOWN):   <PWD>
```

```
WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

          BUILD (B)
          MODIFY (M)
          PLAY (P)
          STATUS (S)
          INITIATE MTM (I)
          QUIT (Q)

ENTER B,M,P,S,I OR Q:  <B>

THIS PORTION OF THE PROGRAM WILL ALLOW THE CONTROLLER TO:


        1. DESIGN THE ORGANIZATIONAL STRUCTURE FOR THE GAME

        2. DESIGN THE COMM NET SUPPORTING THE ORGANIZATION


HOW MANY PLAYERS, INCLUDING THE CONTROLLER, ARE THERE?  <8>

THE NUMBER OF PLAYERS IS: 8
```

```
WHAT ARE THE (GAME) NAMES OF THE PLAYERS IN THE GAME?
(ENTER <CR> WHEN FINISHED)

PLAYER 1: CONTROLLER
WHAT IS PLAYER 1 VAX DIRECTORY NAME?: WG1
PLAYER 2: AFCENT
WHAT IS PLAYER 2 VAX DIRECTORY NAME?: WG2
PLAYER 3: NORTHAG
WHAT IS PLAYER 3 VAX DIRECTORY NAME?: WG3
PLAYER 4: AAFCE
WHAT IS PLAYER 4 VAX DIRECTORY NAME?: WG4
PLAYER 5: CENTAG
WHAT IS PLAYER 5 VAX DIRECTORY NAME?: WG5
PLAYER 6: 4ATAF
WHAT IS PLAYER 6 VAX DIRECTORY NAME?: WG6
PLAYER 7: 2ATAF
WHAT IS PLAYER 7 VAX DIRECTORY NAME?: WG7
PLAYER 8: BLUE
WHAT IS PLAYER 8 VAX DIRECTORY NAME?: BLUE

YOU HAVE NAMED  8   PLAYERS


IF YOU WISH EACH PLAYER TO HAVE A COMPLETE COMMUNICATION
SUITE (I.E., TO BE ABLE TO COMMUNICATE DIRECTLY WITH EVERY
OTHER PLAYER VIA ANY LINK), TYPE "ALL".  OTHERWISE, TYPE <CR>.

CHOICE:  <ALL>

RETURN TO MAIN MENU BY DEPRESSING <CR>:  <CR>
```

```
WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

        BUILD (B)
        MODIFY (M)
        PLAY (P)
        STATUS (S)
        INITIATE MTM (I)
        QUIT (Q)


ENTER B,M,P,S,I OR Q:  <M>


PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:


          Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

          1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
              USED FOR EACH TYPE LINK.

          2.  SET PROBABILITY OF MESSAGE GARBLING.

          3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

          4.  SET RATE OF MESSAGE GARBLING.

          5.  REMOVE PLAYERS FROM THE GAME.

          6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
                   (STATUS DISPLAYED)
```

```
#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)


ENTER Ø,1,2,3,4,5,6 OR 7 :  <Ø>


YOU WISH TO CHANGE THE COMMUNICATION LINK CODE BETWEEN
TWO GAME PLAYERS.


CHANGE LINK CODE FROM PLAYER (NAME): <AFCENT>
TO PLAYER: <AAFCE>


ENTER A SIX DIGIT NUMBER CONSISTING OF Ø'S AND 1'S
TO INDICATE CIRCUIT AVAILABILITY BETWEEN PLAYER PAIRS
IN THE POSITIONAL ORDER SHOWN BELOW (I.E., 1ØØØ1Ø
REPRESENTS AN ENCRYPTED LANDLINE AND A VOICE CIRCUIT).


          1 -- ENCRYPTED LANDLINE (AUTODIN)
          2 -- NON-ENCRYPTED LANDLINE (TELETYPE)
          3 -- DIGITAL RF CIRCUIT (HF/VHF/UHF) WITH A/J
          4 -- ANALOG RF WITHOUT A/J
          5 -- VOICE (TELEPHONE)
          6 -- PERFECT LINK (NO DELAY, NO DEGRADATION)

123456      THE CURRENT LINK CODE IS :
111111

ENTER NEW LINK CODE: <1111ØØ>
```

```
PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

          Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

          1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
              USED FOR EACH TYPE LINK.

          2.  SET PROBABILITY OF MESSAGE GARBLING.

          3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

          4.  SET RATE OF MESSAGE GARBLING.

          5.  REMOVE PLAYERS FROM THE GAME.

          6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
                   (STATUS DISPLAYED)

#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)

ENTER Ø,1,2,3,4,5,6 OR 7 :  <1>
```

```
BASED ON THE QUEUING ALGORITHM FOR SINGLE SERVER
FACILITIES, THE AVERAGE AMOUNT OF TRANSMISSION DELAY
FOR MESSAGES ADDRESSED TO A GIVEN FACILITY (WQ)
CAN BE EXPRESSED AS A FUNCTION OF THE AVERAGE
MESSAGE ARRIVAL RATE (A) AND THE AVERAGE MESSAGE
SERVICE RATE (S).

         WQ = A/S(S-A)
YOU MAY SPECIFY THE ACTUAL ARRIVAL RATES AND
SERVICE RATES FOR EACH CLASS OF COMMUNICATIONS
(1 THROUGH 5) OR YOU MAY RELY UPON A PRE-ESTABLISHED
SERVICE RATE AND ARRIVAL RATE RELATIONSHIP AND
VARY ONLY THE MESSAGE ARRIVAL RATE BY REQUESTING:

      A.  NORMAL TRAFFIC
      B.  MEDIUM TRAFFIC (TWICE THE NORMAL ARRIVAL RATE)
      C.  HEAVY TRAFFIC (THREE TIMES THE NORMAL RATE)

TYPE "1" TO INSERT SPECIFIC ARRIVAL AND SERVICE RATES.

TYPE "2" TO USE THE GENERAL RATES (NORMAL, MEDIUM, HEAVY).

NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES CURRENTLY
        SET -- TYPE <CR>.


ENTER 1, 2, OR <CR> : <2>
```

```
THE PRE-ESTABLISHED RELATIONSHIP BETWEEN ARRIVAL
AND SERVICE RATES FOR A NORMAL ARRIVAL RATE IS
AS FOLLOWS:

          FOR CIRCUIT TYPE 1: S = 3.Ø1A

          FOR CIRCUIT TYPE 2: S = 3.Ø5A

          FOR CIRCUIT TYPE 3: S = 3.Ø4A

          FOR CIRCUIT TYPE 4: S = 3.Ø3A

          FOR CIRCUIT TYPE 5: S = 3.Ø2A

ENTER "NORMAL", "MEDIUM" OR "HEAVY" TO ESTABLISH
THE INITIAL MESSAGE ARRIVAL RATES.

CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY".

NORMAL, MEDIUM OR HEAVY?:  <NORMAL>
```

```
PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

          Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

          1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
              USED FOR EACH TYPE LINK.

          2.  SET PROBABILITY OF MESSAGE GARBLING.

          3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

          4.  SET RATE OF MESSAGE GARBLING.

          5.  REMOVE PLAYERS FROM THE GAME.

          6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
                 (STATUS DISPLAYED)

#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)

ENTER Ø,1,2,3,4,5,6 OR 7 :  <2>,
ENTER THE PROBABILITY THAT A MESSAGE WILL BE
GARBLED DURING TRANSMISSION.  FIVE EQUALS
FIVE PERCENT.  USE INTEGER VALUES.

TYPE "1" IF YOU WISH TO ENTER A SEPARATE PROBABILITY
FOR EACH CIRCUIT TYPE. (1-5)

TYPE "2" IF YOU WANT A STANDARD PROBABILITY FOR ALL
CIRCUITS.

NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
       CURRENTLY SET -- TYPE <CR>

ENTER THE MESSAGE GARBLE PROBABILITY FOR EACH CIRCUIT


FOR CIRCUIT TYPE [ ]:

        PROBABILITY =

   OR:

ENTER THE STANDARD PROBABILITY FOR ALL CIRCUITS

        PROBABILITY =

CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY".

ENTER 1, 2, OR <CR> :  <1>
ENTER THE MESSAGE GARBLE PROBABILITY FOR EACH CIRCUIT

 FOR CIRCUIT TYPE [ 1 ]:
PROBABILITY = <5>
 FOR CIRCUIT TYPE [ 2 ]:
PROBABILITY = <5>
 FOR CIRCUIT TYPE [ 3 ]:
PROBABILITY = <10>
 FOR CIRCUIT TYPE [ 4 ]:
PROBABILITY = <7>
 FOR CIRCUIT TYPE [ 5 ]:
PROBABILITY = <6>
          .

PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

           0.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

           1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
               USED FOR EACH TYPE LINK.

           2.  SET PROBABILITY OF MESSAGE GARBLING.

           3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

           4.  SET RATE OF MESSAGE GARBLING.

           5.  REMOVE PLAYERS FROM THE GAME.

           6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

         # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
```

```
#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)


ENTER Ø,1,2,3,4,5,6 OR 7 :  <3>


ENTER THE RATE FOR MESSAGES TO BE "LOST". FIVE
EQUALS FIVE PERCENT. USE INTEGER VALUES.

ENTER "1" IF YOU WISH TO ENTER A SEPARATE LOSS
RATE FOR EACH CIRCUIT TYPE. (1-5)

ENTER "2" IF YOU WANT A STANDARD RATE FOR ALL
CIRCUITS.

NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
       CURRENTLY SET -- TYPE <CR>


ENTER THE LOSS RATE BY COMM CIRCUIT TYPE FOR
CIRCUIT TYPE [ ]:

      LOSS RATE =

  OR:

ENTER THE STANDARD RATE FOR ALL CIRCUITS

      LOSS RATE =

CHANGES TO THESE VALUES WHICH ARE DESIRED DURING THE
GAME SHOULD BE MADE BY RE-ENTERING "MODIFY".

ENTER 1, 2, OR <CR> : <1>
ENTER THE LOSS RATE FOR COMM CIRCUIT TYPE [ 1 ]
LOSS RATE = 6
ENTER THE LOSS RATE FOR COMM CIRCUIT TYPE [ 2 ]
LOSS RATE = 6
ENTER THE LOSS RATE FOR COMM CIRCUIT TYPE [ 3 ]
LOSS RATE = 8
ENTER THE LOSS RATE FOR COMM CIRCUIT TYPE [ 4 ]
LOSS RATE = 8
ENTER THE LOSS RATE FOR COMM CIRCUIT TYPE [ 5 ]
LOSS RATE = 3

PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

          Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

          1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
              USED FOR EACH TYPE LINK.

          2.  SET PROBABILITY OF MESSAGE GARBLING.

          3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

          4.  SET RATE OF MESSAGE GARBLING.

          5.  REMOVE PLAYERS FROM THE GAME.

          6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
```

```
#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)


ENTER Ø,1,2,3,4,5,6 OR 7 :  <4>


ENTER THE RATE AT WHICH YOU WISH MESSAGES TO BE
GARBLED DURING TRANSMISSION. FIVE EQUALS FIVE
PERCENT. USE INTEGER VALUES.

TYPE "1" IF YOU WISH TO ENTER A SEPARATE RATE
FOR EACH CIRCUIT TYPE. (1-5)

TYPE "2" IF YOU WANT A STANDARD RATE FOR ALL
CIRCUITS.

NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
       CURRENTLY SET -- TYPE <CR>

ENTER THE MESSAGE GARBLE RATE FOR EACH CIRCUIT

FOR CIRCUIT TYPE [ ]:

        GARBLE RATE =

   OR:

ENTER THE STANDARD RATE FOR ALL CIRCUITS

        GARBLE RATE =
CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY".

ENTER 1, 2, OR <CR> : <1>

ENTER THE MESSAGE GARBLE RATE FOR EACH CIRCUIT

 FOR CIRCUIT TYPE [ 1 ]
RATE = 3
 FOR CIRCUIT TYPE [ 2 ]
RATE = 5
 FOR CIRCUIT TYPE [ 3 ]
RATE = 10
 FOR CIRCUIT TYPE [ 4 ]
RATE = 10
 FOR CIRCUIT TYPE [ 5 ]
RATE = 10
```

```
PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

          Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

          1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
              USED FOR EACH TYPE LINK.

          2.  SET PROBABILITY OF MESSAGE GARBLING.

          3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

          4.  SET RATE OF MESSAGE GARBLING.

          5.  REMOVE PLAYERS FROM THE GAME.

          6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
                 (STATUS DISPLAYED)

#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)

ENTER Ø,1,2,3,4,5,6 OR 7 :  <5>
ENTER THE NUMBER OF PLAYERS AND THE NAME OF EACH
PLAYER WHO HAS BEEN "DESTROYED" OR WHO FOR SOME
REASON IS TO BE REMOVED FROM THE GAME AFTER GAME
START. ENTER THE NUMBER AND A <CR> AND THE NAME
OF EACH PLAYER WITH A <CR> FOLLOWING EACH NAME.

NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
       CURRENTLY SET -- TYPE <CR>.

NUMBER OF PLAYER(S) TO BE REMOVED = <1>
PLAYER NAME : <NORTHAG>

REMOVED PLAYER IS: NORTHAG
```

```
PARAMETER INITIALIZATION AND MODIFICATION SUBROUTINE

THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:

        Ø.  CHANGE COMMUNICATION LINKS BETWEEN TWO PLAYERS.

        1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE
            USED FOR EACH TYPE LINK.

        2.  SET PROBABILITY OF MESSAGE GARBLING.

        3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

        4.  SET RATE OF MESSAGE GARBLING.

        5.  REMOVE PLAYERS FROM THE GAME.

        6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

      # 7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
               (STATUS DISPLAYED)

#NOTE#: CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
        IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
        RETURNING TO THE MAIN MENU (ITEM #6)

ENTER Ø,1,2,3,4,5,6 OR 7 :  <7>
```

```
                    DISPLAY GAME STATUS

GAME STATUS AS OF 15-MARCH-1982 21:40:44.94

PLAYER1 :  CONTROLLER IN DIRECTORY WG1
PLAYER2 :  AFCENT IN DIRECTORY WG2
PLAYER3 :  NORTHAG IN DIRECTORY WG3
PLAYER4 :  AAFCE IN DIRECTORY WG4
PLAYER5 :  CENTAG IN DIRECTORY WG5
PLAYER6 :  4ATAF IN DIRECTORY WG6
PLAYER7 :  2ATAF IN DIRECTORY WG7
PLAYER8 :  BLUE IN DIRECTORY BLUE

LINK1TO2 ------> 111111
LINK1TO3 ------> 111111
LINK1TO4 ------> 111111
LINK1TO5 ------> 111111
LINK1TO6 ------> 111111
LINK1TO7 ------> 111111
LINK1TO8 ------> 111111
LINK2TO1 ------> 111111
LINK2TO3 ------> 111111
LINK2TO4 ------> 111100   *****NOTE CHANGE
LINK2TO5 ------> 111111
LINK2TO6 ------> 111111
LINK2TO7 ------> 111111
LINK2TO8 ------> 111111
LINK3TO1 ------> 111111
LINK3TO2 ------> 111111
LINK3TO4 ------> 111111
LINK3TO5 ------> 111111
LINK3TO6 ------> 111111
LINK3TO7 ------> 111111
LINK3TO8 ------> 111111
LINK4TO1 ------> 111111
LINK4TO2 ------> 111111
```

```
LINK4T03 ------> 111111
LINK4T05 ------> 111111
LINK4T06 ------> 111111
LINK4T07 ------> 111111
LINK4T08 ------> 111111
LINK5T01 ------> 111111
LINK5T02 ------> 111111
LINK5T03 ------> 111111
LINK5T04 ------> 111111
LINK5T06 ------> 111111
LINK5T07 ------> 111111
LINK5T08 ------> 111111
LINK6T01 ------> 111111
LINK6T02 ------> 111111
LINK6T03 ------> 111111
LINK6T04 ------> 111111
LINK6T05 ------> 111111
LINK6T07 ------> 111111
LINK6T08 ------> 111111
LINK7T01 ------> 111111
LINK7T02 ------> 111111
LINK7T03 ------> 111111
LINK7T04 ------> 111111
LINK7T05 ------> 111111
LINK7T06 ------> 111111
LINK7T08 ------> 111111
LINK8T01 ------> 111111
LINK8T02 ------> 111111
LINK8T03 ------> 111111
LINK8T04 ------> 111111
LINK8T05 ------> 111111
LINK8T06 ------> 111111
LINK8T07 ------> 111111
```

```
ARRIVAL RATE FOR CIRCUIT 1 -----> 3.0  MESSAGES PER MINUTE
ARRIVAL RATE FOR CIRCUIT 2 -----> 3.0  MESSAGES PER MINUTE
ARRIVAL RATE FCR CIRCUIT 3 -----> 3.0  MESSAGES PER MINUTE
ARRIVAL RATE FOR CIRCUIT 4 -----> 3.0  MESSAGES PER MINUTE
ARRIVAL RATE FOR CIRCUIT 5 -----> 3.0  MESSAGES PER MINUTE

SERVICE RATE FOR CIRCUIT 1 -----> 9.30 MESSAGES PER MINUTE
SERVICE RATE FOR CIRCUIT 2 -----> 9.15 MESSAGES PER MINUTE
SERVICE RATE FCR CIRCUIT 3 -----> 9.12 MESSAGES PER MINUTE
SERVICE RATE FOR CIRCUIT 4 -----> 9.09 MESSAGES PER MINUTE
SERVICE RATE FOR CIRCUIT 5 -----> 9.06 MESSAGES PER MINUTE

LOSS RATE FOR CIRCUIT 1 ----->  6%
LOSS RATE FOR CIRCUIT 2 -----> 12%
LOSS RATE FOR CIRCUIT 3 -----> 15%
LOSS RATE FOR CIRCUIT 4 -----> 22%
LOSS RATE FOR CIRCUIT 5 -----> 10%

GARBLE RATE FOR CIRCUIT 1 ----->  8%
GARBLE RATE FOR CIRCUIT 2 -----> 10%
GARBLE RATE FOR CIRCUIT 3 -----> 12%
GARBLE RATE FOR CIRCUIT 4 -----> 17%
GARBLE RATE FOR CIRCUIT 5 -----> 13%

GARBLE PROBABILITY FOR CIRCUIT 1 ----->  8%
GARBLE PROBABILITY FOR CIRCUIT 2 -----> 12%
GARBLE PROBABILITY FOR CIRCUIT 3 -----> 17%
GARBLE PROBABILITY FOR CIRCUIT 4 -----> 22%
GARBLE PROBABILITY FOR CIRCUIT 5 -----> 15%

THE FOLLOWING PLAYERS HAVE BEEN REMOVED:
1.  NORTHAG
```

```
WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

        BUILD (B)
        MODIFY (M)
        PLAY (P)
        INITIATE MTM (I)
        STATUS (S)
        QUIT (Q)

ENTER B,M,P,S,I OR Q:  P

WELCOME TO THE NAVAL POSTGRADUATE SCHOOL C3 WARGAME

HERE IS A LIST OF ALLOWABLE COMMANDS AND THEIR DEFINITIONS

          MAIL        READ INCOMING MAIL
          SENDMSG     SEND A MESSAGE
          READMSG     READ ENTIRE MESSAGE FILE
          HELP        PRINTS THIS HELP MESSAGE
          QUIT        EXITS ENTIRE PROGRAM

COMMANDER, WHAT IS YOUR COMMAND?  <SENDMSG>

TO: <AAFCE,4ATAF,2ATAF>
FROM: <AFCENT>

SELECT CIRCUIT TYPE Ø,1,2,3,4,5,6 OR 7   <3>

SUBJECT: <INTELREP>

<INTELLIGENCE SOURCES HAVE DETECTED ENEMY FORCE CONCENTRATIONS
BEGINNING TO DEVELOP IN THE VICINITY OF FULDA GAP.  SUGGEST
PLACING ALL FORCES IN READY ALERT STATUS.>

<PF1,7,EX,ENTER>
```

```
AAFCE --- OK
4ATAF --- OK
2ATAF --- OK

COMMANDER, WHAT IS YOUR COMMAND?  <QUIT>


WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

        BUILD (B)
        MODIFY (M)
        PLAY (P)
        INITIATE MTM (I)
        STATUS (S)
        QUIT (Q)

ENTER B,M,P,S,I OR Q:  Q

$
```

B. SAMPLE INPUT/OUTPUT

1. PHASE ONE

Traffic loading was set to NORMAL and all parameters were set to their initial values. The transmitted message appeared as illustrated below:

```
FM  CONTROLLER
TO  AFCENT, NORTHAG, AAFCE, CENTAG


SUBJECT: TEST 7.1
THIS MESSAGE CONSTITUTES A TEST OF THE COMMAND, CONTROL AND COMMUNICATIONS
SYSTEM. ALL ADDRESSEES RESPOND WITH THE SPECIAL CODE CONTAINED IN THIS
MESSAGE.

                  SPECIAL CODE: 7777

*NOTE* THIS MESSAGE WILL BE USED TO DETERMINE DEGRADATION OF C3 AT DIFFERENT
TIMES DURING BATTLE EVOLUTION.

TRANSMIT REPLY VIA CIRCUIT: 2
```

Copies of the received messages are stored in [CLARK]MAIL.MAI for post game analysis. The original message, as transmitted, is concatenated with the message statistical data as one copy; another copy of the message is received as it appears to the addressees. Different addressees will receive different copies of the same transmitted message due to variations in circuits between different locations. The analysis copy of the above message appears as follows:

```
From:  WG1            11-MAR-1982 12:35
To:    CLARK
Subj:  MSG

VOICE

11-MAR-1982 12:35:45.25

FM CONTROLLER
TO AFCENT,NORTHAG,AAFCE,CENTAG


BT
SUBJECT: TEST 7.1
THIS MESSAGE CONSTITUTES A TEST OF THE COMMAND, CONTROL AND COMMUNICATIONS
SYSTEM. ALL ADDRESSEES RESPOND WITH THE SPECIAL CODE CONTAINED IN THIS
MESSAGE.

                SPECIAL CODE: 7777

*NOTE* THIS MESSAGE WILL BE USED TO DETERMINE DEGRADATION OF C3 AT DIFFERENT
TIMES DURING BATTLE EVOLUTION.

TRANSMIT REPLY VIA CIRCUIT: 2


MESSAGE DELAY TIME FOLLOWS:
0:00:01.00
```

```
THIS MESSAGE ADDRESSED TO : WG2

IF URAN = Ø.1Ø37283   LESS THAN PGARB  5.9999999E-Ø2  GARBLE IT
GARBLE RATE             5 = Ø.1ØØØØØØ
LOSS RATE            5 = 2.9999999E-Ø2
LINK TYPE =             5
LINK CODE = 111111
I_CKT =            5
SERVICE RATE = 59.3545Ø
ARRIVAL RATE = 19.65381
FACTOR =   3Ø.ØØØØØ
LINK TYPE =            5
DELAY =   2.78Ø165ØE-Ø4  HOURS
STANDARDIZED REAL TIME DELAY = 8.34Ø5552E-Ø3  HOURS
```

The next example showes the analysis copy of a lost message and since the message is lost this is the only place it will appear.

```
From:  WG1           11-MAR-1982 13:Ø5
To:    CLARK
Subj:  MSG

VOICE

11-MAR-1982 13:Ø5:52.85

FM CONTROLLER
TO AFCENT,AAFCE,2ATAF
```

```
BT
SUBJECT: TEST 7.2
THIS MESSAGE CONSTITUTES A TEST OF THE COMMAND, CONTROL AND COMMUNICATIONS
SYSTEM. ALL ADDRESSEES RESPOND WITH THE SPECIAL CODE CONTAINED IN THIS
MESSAGE.

              SPECIAL CODE: 7772

*NOTE* THIS MESSAGE WILL BE USED TO DETERMINE DEGRADATION OF C3 AT DIFFERENT
TIMES DURING BATTLE EVOLUTION.

TRANSMIT REPLY VIA CIRCUIT: 5


THIS MESSAGE ADDRESSED TO : WG7

IF URAN = 5.2703142E-02  LESS THAN P(LOSS)  =  7.9999999E-02  MESSAGE IS LOST
GARBLE RATE             4 = 0.1200000
LOSS RATE            4 = 7.9999999E-02
LINK TYPE =             4
LINK CODE = 111111
I_CKT =              4
```

There were no garbled messages in phase one due primarily to the low message volume and the low probability of garbling.

2. PHASE TWO

The next messages represent the before and after results of further circuit degradation after traffic loading was increased to heavy and the parameters of loss, garbling probabilities and garbling rates were all increased to simulate a jamming environment. The first message is the ungarbled analysis copy.

```
From:  WG5         11-MAR-1982 13:46
To:    CLARK
Subj:  MSG

DIGITAL RF CIRCUIT WITHOUT A/J

11-MAR-1982 13:46:11.77

FM CENTAG
TO AAFCE,NORTHAG


BT
SUBJECT: TEST 8.3
THIS MESSAGE CONSTITUTES A TEST OF THE COMMAND, CONTROL AND COMMUNICATIONS
SYSTEM. ALL ADDRESSEES RESPOND WITH THE SPECIAL CODE CONTAINED IN THIS
MESSAGE.

                SPECIAL CODE: 8883
```

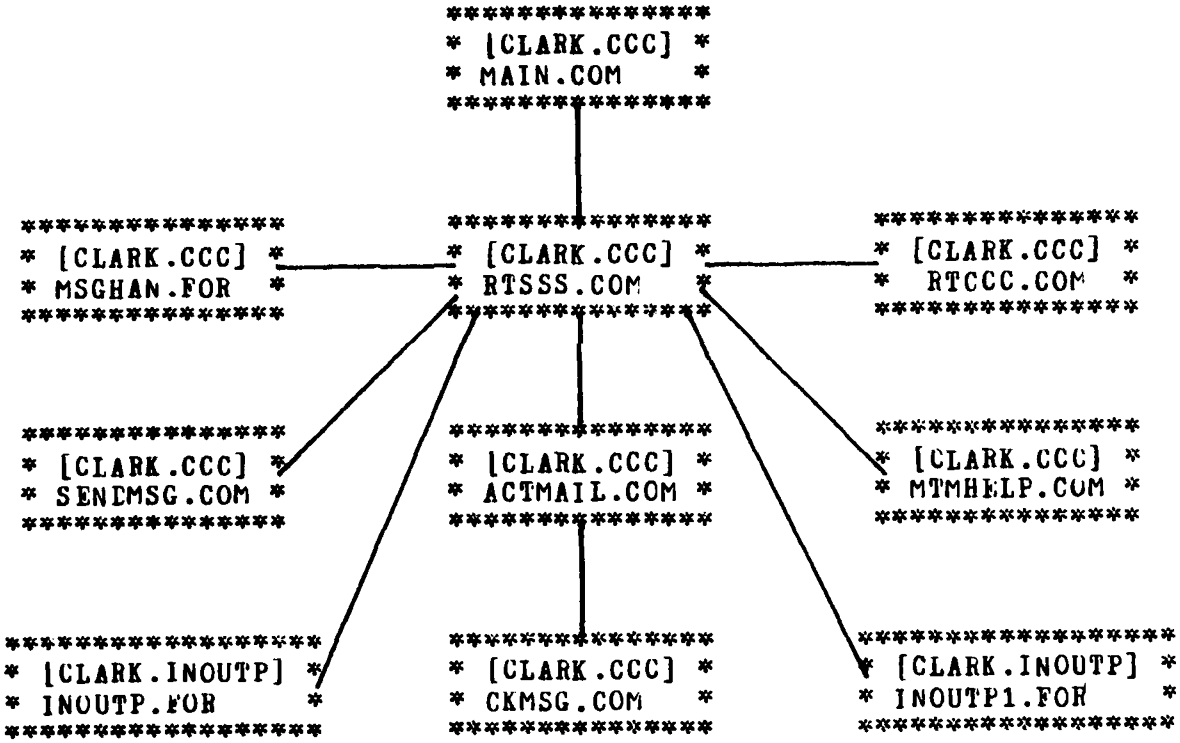
```
*NOTE* THIS MESSAGE WILL BE USED TO DETERMINE DEGRADATION OF C3 AT DIFFERENT
TIMES DURING BATTLE EVOLUTION.

TRANSMIT REPLY VIA CIRCUIT: 5

MESSAGE GARBLED

MESSAGE DELAY TIME FOLLOWS:
Ø:ØØ:Ø1.ØØ

THIS MESSAGE ADDRESSED TO : WG4

IF URAN = 5.27Ø3142E-Ø2  LESS THAN PGARB  Ø.22ØØØØØ      GARBLE IT
GARBLE RATE            4 = Ø.17ØØØØØ
LOSS RATE           4 = Ø.22ØØØØØ
LINK TYPE =           4
LINK CODE = 111111
I_CKT =           4
SERVICE RATE = 17.6Ø469
ARRIVAL RATE = 5.81Ø129
FACTOR =   32.ØØØØØ
LINK TYPE =          4
DELAY =   9.3272614E-Ø4  HOURS
STANDARDIZED REAL TIME DELAY = 2.7981784E-Ø2
```

The second message is the garbled version that would have been received by the addressee.

```
VOICE

11-MAR-1982 13:46:11.77

FM CENTAG
TO AAFCE,NORTHAG


BT
SUBJE-T: TE5T 8.3S  G                   H9          -   3       W *

COMMUDICATIONS SYSUE
SPECK-L CODE CONTA-NED I$%LHWS MERSAGE.          '        Ø   6   ( 7    C
     )        2                              5 @      %   W      Y
4     ,T  E
                SPJ
AL CODE: 8883 SIS .        0Q .2 J 2 P A     8    3  E" C P        / W
 .1 97Q  K         IE          .     &       0 Q         Q3     B
*N-TE74TH
 OESTAGE WXLL BE USED TO DEVERMINE DEHDR;DA.I@N OF   4  5   GK? UI
C3 A& EIFF@REWT 2JMES D&QING BAT@LF FV LUTICN.        ; 9       (     +9
          W -            #       V1     %          M U?   A.@          " )   PF
I    M       3 + (
       $        D   Ø  6            SQ

T3´NSMIT RJPLYZVWA*BIRC
                                     W P    (         A
T: 5Z   E     P ;                 0 G  " 1 A       7       X   @  *
     V       N   8J
```

APPENDIX D

C3 MODEL BLOCK DIAGRAM



FILES USED BY EACH MODULE:

```
1.  [CLARK.CCC]MAIN.COM

        [CLARK]PARAMETER.DAT
        [CLARK]INTERFACE.DAT
        [CLARK]DATA.TMP
        [CLARK]DATA1.TMP
        [CLARK]DATA2.TMP
        DOCUMENT.DAT
        STATUS.DAT

2.  [CLARK.CCC]RTSSS.COM

        [CLARK.CCC]MSG.TXT
        MSGOUT.TXT
        MESSAGE.TXT

3.  [CLARK.CCC]SENDMSG.COM

        HEADER.TXT

4.  [CLARK.CCC]ACTMAIL.COM

        MAIL.MAI

5.  [CLARK.CCC]MTMHELP.COM

        NONE

6.  [CLARK.CCC]CKMSG.COM

        MAILING.TMP
        MAILING.DAT

7.  [CLARK.CCC]MSGHAN.FOR

        [CLARK]FACTOR
        [CLARK]PARAMETER.DAT
        [CLARK.CCC]LETTER,TXT
        MAILING.TMP
        MSGOUT.TXT
        MESSAGE.TXT
        SEEDØ.DAT
        SEED1.DAT
        SEED2.DAT
        SEED3.DAT
        SEED4.DAT
        SEED5.DAT
        SEED6.DAT
```

```
          SEED7.DAT
          STAT1.TXT
          STAT2.TXT
          STAT3.TXT
          STAT4.TXT
          STAT5.TXT
          STAT6.TXT
          STAT7.TXT
          STAT8.TXT
          STAT9.TXT
          GARBL1.TXT
          GARBL2.TXT
          GARBL3.TXT
          GARBL4.TXT
          GARBL5.TXT
          GARBL6.TXT
          GARBL7.TXT
          GARBL8.TXT
          GARBL9.TXT

 8.   CREAT.FOR

          WARDATA.DAT
          NEWDATA.DAT

 9.   [CLARK.CCC]RTCCC.COM

          [CLARK.CCC]MSG.TXT
          MSGOUT.TXT
          MESSAGE.TXT
```

****

NOTES ON ORGANIZATION AND STRUCTURE OF THE C3 COMMUNICATIONS REQUIREMENTS PROGRAM (CRP), MAIN.COM.

1. ALL COMMON MODULES ARE IN THE FOLLOWING DIRECTORY OR SUB-DIRECTORY.

```
[CLARK]
[CLARK.CCC]
```

2. MAIN PROGRAM.

```
[CLARK.CCC]MAIN.COM  (MAIN PROGRAM)
```

3. DESCRIPTION:

THE MAIN MODULE FIRST CLEARS THE LOCAL SYMBOL TABLE. THIS IS SIMPLY A HOUSEKEEPING MEASURE (STARTING WITH A CLEAN SLATE).

THE INITIALIZE SECTION READS IN PREVIOUSLY DEFINED GAME DATA FROM [CLARK]PARAMETER.DAT

DATA IN THIS FILE IS IN THE FOLLOWING FORMAT:

```
ARRIVAL_RATE1
ARRIVAL_RATE2
ARRIVAL_RATE3
ARRIVAL_RATE4
ARRIVAL_RATE5
SERVICE_RATE1
SERVICE_RATE2
SERVICE_RATE3
SERVICE_RATE4
SERVICE_RATE5                *************************
LOSS_RATE1                   * NUMBERS 1-5 REFER TO *
LOSS_RATE2                   * THE CIRCUIT LNKTYP   *
LOSS_RATE3                   *************************
LOSS_RATE4
LOSS_RATE5
GARBLE_RATE1  (PERCENTAGE OF GARBLED TEXT OF
GARBLE_RATE2   MESSAGES THAT ARE TO BE GARBLED.)
GARBLE_RATE3
GARBLE_RATE4
GARBLE_RATE5
PGARB1        (PROBABILITY THAT A MESSAGE WILL BE
PGARB2         GARBLED.)
PGARB3
PGARB4
PGARB5
RM_PLAYER_CNT (NUMBER OF REMOVED PLAYERS)
```

```
NAME OF REMOVED PLAYER (IF ANY)
NAME OF REMOVED PLAYER (IF ANY)
NAME OF REMOVED PLAYER (IF ANY)
.
.              RM_PLAYER_CNT NUMBER OF NAMES LISTED
.
NAME OF REMOVED PLAYER (IF ANY)
END OF FILE
```

IT ALSO READS GAME DATA FROM A SECOND FILE
[CLARK]INTERFACE.DAT

DATA IN THIS FILE IS IN THE FOLLOWING FORMAT.

```
PLAYCNT (NUMBER OF PLAYERS IN THE GAME)
PLAYER1 REAL NAME
PLAYER1 VAX DIRECTORY NAME
PLAYER2 REAL NAME
PLAYER2 VAX DIRECTORY NAME
.
.  THERE WILL BE 'PLAYCNT' NAMES LISTED
.
LINK1TO2
LINK1TO3 (IF THREE PLAYERS AND SO ON UNTIL PLAYCNT)
LINK2TO1
LINK2TO3 (IF THREE PLAYERS AND SO ON UNTIL PLAYCNT)
.
.  PLAYER DO NOT HAVE LINKS TO THEMSELVES
.
END_OF_FILE
```

IN ADDITION, THIS SECTION EXTRACTS THE LOGIN NAME OF THE PLAYER WHICH IS USED LATER TO DETERMINE THE PLAYER'S ELIGIBILITY TO PLAY THE GAME.

THE MODULE REQUESTS THE PLAYER TO ENTER ALL KNOWN PASSWORDS AND PRIVILEGE CODES.
THE PRIVILEGE CODE GIVES THE USER GAME PARAMETER MODIFICATION/CHANGE PRIVILEGES

IF THE PLAYER IS NOT PRIVILEGED, THEN THE PROGRAM BRANCHES TO PROCEDURE [CLARK.CCC]RTCCC.COM (IF USER IS A COMMUNICATIONS-ONLY PLAYER) OR TO THE MCCLINTIC THEATER MODEL INPUT/OUTP PROGRAM.

IF THE PLAYER IS PRIVILEGED, THEN HE HAS THE OPTION OF SELECTING THE BUILD, MODIFY,STATUS OR PLAY PORTION OF THE PROGRAM.

****

NOTES ON ORGANIZATION AND STRUCTURE OF THE C3 COMMUNICATIONS REQUIREMENTS PROGRAM (CRP) COMMUNICATIONS PORTION ONLY.

1. ALL COMMON MODULES ARE IN THE FOLLOWING DIRECTORY OR SUB-DIRECTORY.

   [CLARK]
   [CLARK.CCC]

2. MAIN PROGRAM.

   [CLARK.CCC]MAIN1.COM (MAIN PROGRAM)

   DESCRIPTION:

   THE MAIN1 MODULE FIRST CLEARS THE LOCAL SYMBOL TABLE. THIS IS SIMPLY A HOUSE-KEEPING MEASURE (STARTING WITH A CLEAN SLATE).

   THE INITIALIZE SECTION READS IN PREVIOUSLY DEFINED GAME DATA FROM [CLARK]PARAMETER.DAT

   DATA IN THIS FILE IS IN THE FOLLOWING FORMAT:

```
ARRIVAL_RATE1
ARRIVAL_RATE2
ARRIVAL_RATE3
ARRIVAL_RATE4
ARRIVAL_RATE5
SERVICE_RATE1
SERVICE_RATE2
SERVICE_RATE3
SERVICE_RATE4
SERVICE_RATE5            ************************
LOSS_RATE1               * NUMBERS 1-5 REFER TO *
LOSS_RATE2               * THE CIRCUIT LNKTYP   *
LOSS_RATE3               ************************
LOSS_RATE4
LOSS_RATE5
GARBLE_RATE1  (PERCENTAGE OF GARBLED TEXT OF MESSAGES
GARBLE_RATE2   THAT ARE TO BE GARBLED.)
GARBLE_RATE3
GARBLE_RATE4
GARBLE_RATE5
PGARB1        (PROBABILITY THAT A MESSAGE WILL BE
PGARB2         GARBLED.)
PGARB3
PGARB4
PGARB5
```

```
RM_PLAYER_CNT (NUMBER OF REMOVED PLAYERS)
NAME OF REMOVED PLAYER (IF ANY)
NAME OF REMOVED PLAYER (IF ANY)
NAME OF REMOVED PLAYER (IF ANY)
.
.          RM_PLAYER_CNT NUMBER OF NAMES LISTED
.
NAME OF REMOVED PLAYER (IF ANY)
END OF FILE
```

IT ALSO READS GAME DATA FROM A SECOND FILE [CLARK]INTERFACE.DAT

DATA IN THIS FILE IS IN THE FOLLOWING FORMAT.

```
PLAYCNT (NUMBER OF PLAYERS IN THE GAME)
PLAYER1 REAL NAME
PLAYER1 VAX DIRECTORY NAME
PLAYER2 REAL NAME
PLAYER2 VAX DIRECTORY NAME
.
.  THERE WILL BE 'PLAYCNT' NAMES LISTED
.
LINK1TO2
LINK1TO3 (IF THREE PLAYERS AND SO ON UNTIL PLAYCNT)
LINK2TO1
LINK2TO3 (IF THREE PLAYERS AND SO ON UNTIL PLAYCNT)
.
.  PLAYER DO NOT HAVE LINKS TO THEMSELVES
.
END_OF_FILE
```

IN ADDITION, THIS SECTION EXTRACTS THE LOGIN NAME OF THE PLAYER WHICH IS USED LATER TO DETERMINE THE PLAYER'S ELIGIBILITY TO PLAY THE GAME.

THE MODULE REQUESTS THE PLAYER TO ENTER <CR> TO CONTINUE. HOWEVER, IN THE BLIND, IT IS REQUESTING A PRIVILEGE CODE THAT GIVES THE USER GAME PARAMETER MODIFICATION/CHANGE PRIVILEGES

IF THE PLAYER IS NOT PRIVILEGED, THEN THE PROGRAM BRANCHES TO PROCEDURE [CLARK.CCC]RTCCC.COM (SEE BELOW DESCRIPTION OF [CLARK.CCC]RTCCC)

IF THE PLAYER IS PRIVILEGED, THEN HE HAS THE OPTION OF SELECTING THE BUILD, MODIFY,STATUS OR PLAY PORTION OF THE PROGRAM.

APPENDIX F

C3 MODEL PROGRAM CODE

```
*** MAIN.COM ***

$ !SET NOVERIFY
$ DEL/SYM/LOCAL/ALL   ! CLEAR LOCAL SYMBOL TABLE
$ !
$ !
$ !        ********** INITIALIZE SECTION  ************
$ !
$ ! THIS SECTION READS IN THE GAME DATA (IF ANY) AND STORES
$ ! THEM IN THE LOCAL TABLE.
$ !
$   INITIAL1:
$       OPEN/READ/ERROR=END_OF_DATA INFILE DRA0:[CLARK]PARAMETER.DAT
$ !
$       CNT = 1
$   INLOOP1:
$       READ/END_OF_FILE=END_OF_DATA INFILE ARRIVAL_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP1
$ !
$       CNT = 1
$   INLOOP2:
$       READ/END_OF_FILE=END_OF_DATA INFILE SERVICE_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP2
$ !
$       CNT = 1
$   INLOOP3:
$       READ/END_OF_FILE=END_OF_DATA INFILE LOSS_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP3
$ !
$       CNT = 1
$   INLOOP4:
$       READ/END_OF_FILE=END_OF_DATA INFILE GARBLE_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP4
$ !
$ !
$       CNT = 1
$   INLOOP4A:
$       READ/END_OF_FILE=END_OF_DATA INFILE PGARB'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP4A
$ !
$       READ/END_OF_FILE=END_OF_DATA INFILE RM_PLAYER_CNT
$ !
$       IF RM_PLAYER_CNT .EQ. Ø THEN GOTO JUMP5
$       CNT = 1
$   INLOOP5:
$       READ/END_OF_FILE=END_OF_DATA INFILE RM_PLAYER_NAME'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. RM_PLAYER_CNT THEN GOTO INLOOP5
$ !
$   JUMP5:
$ !
$   END_OF_DATA:
$ !
$       CLOSE INFILE
$ !
$ !
$       OPEN/READ/ERROR=EEND_OF_DATA INFILE3 DRAØ:[CLARK]INTERFACE.DAT
$       READ/END_OF_FILE=EEND_OF_DATA INFILE3 PLAYCNT
$       CNT = 1
$   INLOOP6:
```

```
$       READ/END_OF_FILE=EEND_OF_DATA INFILE3 NAME
$       PLAYER'CNT' :== "''NAME'"
$       READ/END_OF_FILE=EEND_OF_DATA INFILE3 RNAME
$       DIRECTORY_NAME'CNT' :== "''RNAME'"
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO INLOOP6
$ !
$ CNT = 1
$ KNT = 1
$ INLOOP7:
$       IF CNT .EQ. KNT THEN GOTO INSKIP3
$ !
$       READ/END_OF_FILE=EEND_OF_DATA INFILE3 LINK
$       LINK'CNT'TO'KNT' :== "''LINK'"
$ !
$  INSKIP3:
$       KNT = KNT + 1
$       IF KNT .LE. PLAYCNT THEN GOTO INLOOP7
$       KNT = 1
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO INLOOP7
$ !
$ EEND_OF_DATA:
$ !
$       CLOSE INFILE3
$ !
$ !  THIS SECTION THE PLAYERS DIRECTORY NAME FOR LATER
$ !  USE IN THE MAILER PROGRAM.  IT DEFINES A GLOBAL
$ !  SYMBOL (REAL_FROM) WHICH IDENTIFIES THIS DIRECTORY
$ !  NAME TO THE MAILLER.
$ !
$       TTT := 'F$DIRECTORY()'
$       CNT = 'F$LOCATE(".",TTT)'
$       IF CNT .EQ. 'F$LENGTH(TTT) THEN GOTO CHECK_FOR_A_BRACKET
$       CNT = CNT - 1
```

AD-A115 751   NAVAL POSTGRADUATE SCHOOL MONTEREY CA   F/G 17/2
COMMUNICATIONS PROCESSOR FOR C(3) ANALYSIS AND WARGAMING.(U)
MAR 82 L N CLARK, L D PLESS, R L RAPP

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$       REAL_FROM :== "''F$EXTRACT(1,CNT,TTT)'"
$       GOTO FOUND_DIRECTORY_NAME
$ !
$ CHECK_FOR_A_BRACKET:
$ !
$       CNT = 'F$LOCATE("]",TTT)'
$       CNT = CNT - 1
$       REAL_FROM :== 'F$EXTRACT(1,CNT,TTT)'
$ !
$ FOUND_DIRECTORY_NAME:
$ !
$ !
$  INITIALIZATION_COMPLETE:
$ !
$  LINK_CODE_CHANGED := "NO"  ! INITIALIZING LINK CHANGE FLAG..
$ !
$ !      ************** END  SECTION INITIALIZE *************
$ !
$ TYPE SYS$INPUT

        WELCOME TO THE NAVAL POSTGRADUATE SCHOOL C3 WARGAME


        THIS GAME IS THE RESULT OF A THESIS FOR THE C-3 CURRICULUM
  BY CAPTAIN LLOYD CLARK, CAPTAIN LARRY FLESS AND MAJOR BOB RAPP.


  IT REPRESENTS AN IMPROVED ADAPTATION OF A STRUCTURED COMMUNICATIONS
  MODEL FIRST DEVELOPED BY LT COL TOM STACK AND LCDR TOM SFCORSKY.

  THE WARGAME ITSELF IS THE MCCLINTIC THEATER MODEL (MTM) DEVELOPED
  AT THE US ARMY WAR COLLEGE.

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```
$  SET TERMINAL /NOECHO
$  INQUIRE PWD "MTM PLAYERS ENTER GAME PASSWORD. (ENTER <CR> IF UNKNOWN)"
$  SET TERMINAL /ECHO
$  IF PWD .NES. "CCC" THEN PWD := "NO"
$ !
$  SET TERMINAL /NOECHO
$  INQUIRE PRIV_CODE "CONTROLLER ENTER PASSWORD. (ENTER <CR> IF UNKNOWN)"
$  SET TERMINAL /ECHO
$ !
$  IF PRIV_CODE .EQS. "JWT" THEN GOTO PRIVILEGES
$  PRIV_CODE := "NO PRIVILEGES"
$ !
$ ! IF THE USER IS NOT A PRIVILEGED USER THEN ACTIVATE THE PLAYER
$ ! PORTION OF THE MODEL ONLY.
$ !
$  GAME:
$ !
$  IF PWD .EQS. "CCC" THEN @[CLARK.CCC]RTSSS.COM  ! PLAYER PORTION OF THE GAME
$  IF PWD .EQS. "NO"  THEN @[CLARK.CCC]RTCCC.COM  ! PLAYER PORTION OF THE GAME
$ !
$  IF PRIV_CODE .EQS. "JWT" THEN GOTO PRIVILEGES
$ !
$ !  HOUSEKEEPING... CLEAN UP DIRECTORY OF MISC FILES
$ !
$  CLEAN_HOUSE:
$ !
$  SET MESSAGE /NOTEXT/NOFACILITY/NOIDENTIFICATION/NOSEVERITY ! STOP DISPLAY
$  DELETE GAREL*.TXT.*
$  DELETE MAILING.DAT.*
$  DELETE SEED*.DAT.*
$  DELETE MAILING.TMP.*
$  DELETE STAT*.TXT.*
$  DELETE MSGOUT.TXT.*
$  DELETE HEALER.TXT.*
$  DELETE SENDMSG.TXT.*
$  DELETE STATISTIC.SRT.*
$  DELETE FORØ*.DAT.*
$  DELETE SENDMSG.LOG.*
$  SET MESSAGE /TEXT/FACILITY/IDENTIFICATION/SEVERITY ! RESUME DISPLAY OF ERROR
$ !
$  EXIT
$ !
$  PRIVILEGES:
$ TYPE SYS$INPUT


      WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

              BUILD (B)
              MODIFY (M)
              PLAY (P)
              STATUS (S)
              INITIATE MTM (I)
              QUIT (Q)

$ !
$  LOOP1:
$       INQUIRE ANSWER " ENTER B,M,P,S,I OR Q"
$ !
$       IF ANSWER .EQS. "B" .OR. ANSWER .EQS. "BUILD" THEN GOTO ENTRY1
$       IF ANSWER .EQS. "M" .OR. ANSWER .EQS. "MODIFY" THEN GOTO ENTRY2
$       IF ANSWER .EQS. "P" .OR. ANSWER .EQS. "PLAY" THEN GOTO GAME
$       IF ANSWER .EQS. "S" .OR. ANSWER .EQS. "STATUS" THEN GOTO GAME_STATUS
$       IF ANSWER .EQS. "I" .OR. -
           ANSWER .EQS. "INITIATE MTM" THEN GOTO MTM
$       IF ANSWER .EQS. "Q" .OR. ANSWER .EQS. "QUIT" THEN GOTO CLEAN_HOUSE
$  GOTO LOOP1
$ !
$   MTM:
$ !
$ !  THIS SECTION CALLS A PROCEDURES THAT ALLOWS THE USER TO INITIATE
$ !  THE MCCLINTIC THEATER MODEL WARGAME AND/OR CREATE A NEW DATA BASE
$ !  FOR THE WARGAME.
$ !
$  @[CLARK.CCC]MTM.COM
$ !
$  GOTO MENU
$ !
$   GAME_STATUS:
$ !
$  TYPE SYS$INPUT


                 DISPLAY GAME STATUS

$   OPEN/READ STATUS_FILE [CLARK]INTERFACE.DAT
$   OPEN/WRITE OUTFILE STATUS.DAT
$ !
$       WRITE OUTFILE " GAME STATUS AS OF ''F$TIME()'"
$       WRITE OUTFILE " "
$       READ STATUS_FILE STAT_CNT
$   CNT = 1
$   STATUS_LOOP:
$       READ STATUS_FILE NAME1
$       READ STATUS_FILE NAME2
$       WRITE OUTFILE " PLAYER''CNT' :  ''NAME1' IN DIRECTORY ''NAME2'"
$       CNT = CNT + 1
$       IF CNT .LE. STAT_CNT THEN GOTO STATUS_LOOP
$       WRITE OUTFILE " "
$       WRITE OUTFILE " "
$ !
$   CNT = 1
$   KNT = 1
```

```
         IN THE POSITIONAL ORDER SHOWN BELOW (I.E., 100010
         REPRESENTS AN ENCRYPTED LANDLINE AND A VOICE CIRCUIT).


         1 -- ENCRYPTED LANDLINE (AUTODIN)
         2 -- NON-ENCRYPTED LANDLINE (TELETYPE)
         3 -- DIGITAL RF CIRCUIT (HF/VHF/UHF) WITH A/J
         4 -- DIGITAL RF CIRCUIT WITHOUT A/J PRCTECTION
         5 -- VOICE (TELEPHONE)
         6 -- PERFECT LINK (NC DELAY, NO DEGRADATION)

         NOTE: ALL COMM LINKS HAVE BEEN PRESET TO 0.  ENTER THE
         DESIRED VALUE AS THE CHOICE IS PRESENTED TO YOU
         PLUS <CR> (IF NO COMM LINK EXISTS, TYPE <CR> ONLY).

$ !
$ !      THIS SECTION ACQUIRES THE CIRCUIT VALUES
$ !      AND STORES THE VALUE IN LINK<NUM>TO<NUM>
$ !
$  CNT = 1
$  KNT = 1
$        OPEN/WRITE OUTFILE DRA0:[CLARK]DATA1.TMP
$   LOOP5:
$        IF CNT .EQ. KNT THEN COTO SKIP2
$ !
$        PYR1 := "'""'"PLAYER'CNT'"'"
$        PYR2 := "'""'"PLAYER'KNT'"'"
$ !
$        INQUIRE ANSWER2 -
           " THE CIRCUIT VALUE BETWEEN ''PYR1' AND "''PYR2' IS"
$        IF ANSWER2 .EQS. "" THEN ANSWER2 := 000000
$        LINK'CNT'TO'KNT' :== 'ANSWER2'
$        WRITE OUTFILE 'LINK''CNT'TO''KNT'   =  ''ANSWER2'"
$        WRITE OUTFII3 "''ANSWER2'"
$   SKIP2:
```

```
$       COUNT = COUNT + 1
$       IF COUNT .LE. PLAYCNT THEN GOTO LOOP2
$       COUNT = COUNT - 1
$ !
$       WRITE OUTFIL2 " "
$       WRITE OUTFIL2 " "
$ !
$       CLOSE OUTFILE
$       CLOSE OUTFIL2
$ !
$       ASSIGN/USER_MODE STATISTIC.SRT SYS$OUTPUT:
$       SORT/KEY=(POSITION:1,SIZE=2Ø) DRAØ:[CLARK]DATA.TMP DRAØ:[CLARK]DOC.SRT
$ !
$       OPEN/WRITE OUTFILE DOCUMENT.DAT
$       WRITE OUTFILE " PLAYER NAMES AS OF ''F$TIME()'"
$       WRITE OUTFILE " "
$ !
$       CLOSE OUTFILE
$ !
$   SKIP1:
$ !
$  WRITE SYS$OUTPUT " YOU HAVE NAMED ''COUNT' PLAYERS"
$ !
$  TYPE SYS$INPUT

IF YOU WISH EACH PLAYER TO HAVE A COMPLETE COMMUNICATION
SUITE (I.E., TO BE ABLE TO COMMUNICATE DIRECTLY WITH EVERY
OTHER PLAYER VIA ANY LINK), TYPE "ALL".  OTHERWISE, TYPE <CR>.

$  INQUIRE CHOICE
$  IF CHOICE .EQS. "ALL" THEN GOTO SETVAL
$  TYPE SYS$INPUT

        ENTER A SIX DIGIT NUMBER CONSISTING OF Ø's AND 1's
        TO INDICATE CIRCUIT AVAILABILITY BETWEEN PLAYER PAIRS
```

```
$  PLAYCNT :== 'LPLAYCNT'
$  PLAYCNT := 'LPLAYCNT'
$ !
$  WRITE SYS$OUTPUT " THE NUMBER OF PLAYERS IS: ''PLAYCNT'"
$ !
$  TYPE SYS$INPUT

       WHAT ARE THE (GAME) NAMES OF THE PLAYERS IN THE GAME?
       (ENTER <CR> WHEN FINISHED)

$      OPEN/WRITE OUTFILE DRAØ:[CLARK]DATA.TMP ! CREATE AND OUTPUT FILE
$      OPEN/WRITE OUTFIL2 DRAØ:[CLARK]DATA2.TMP ! CREATE AND OUTPUT FILE
$      OPEN/WRITE OUTFIL3 DRAØ:[CLARK]INTERFACE.DAT ! CREATE AND OUTPUT FILE
$      WRITE OUTFIL2 " "
$      WRITE OUTFIL2 " "
$      WRITE OUTFIL3 "''PLAYCNT'"
$ !
$      COUNT = 1
$   LOOP2:
$ !
$      INQUIRE NAME "PLAYER''COUNT'"
$      PLAYER'COUNT' :== 'NAME'
$ !
$      INQUIRE RNAME "WHAT IS PLAYER''COUNT' VAX DIRECTORY NAME?"
$      DIRECTORY_NAME'COUNT' :== 'RNAME'
$ !
$ !  THE FOLLOWING PROCEDURE STORES THE PLAYER/LINK
$ !  ON FILE DRAØ:[CLARK]DATA.TMP
$ !
$      WRITE OUTFILE "''NAME'"
$      WRITE OUTFIL2 "PLAYER''COUNT' :  ''NAME'   IN DIRECTORY   ''RNAME'"
$      WRITE OUTFIL3 "''NAME'"
$      WRITE OUTFIL3 "''RNAME'"
$ !
$      IF NAME .EQS. "" THEN GOTO LOOP2
$       WRITE OUTFILE " GARBLE PROBABILITY FOR CIRCUIT ''CNT' -----> ''RATE'%"
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO STATUS_LOOP6
$ !
$       READ STATUS_FILE RM_CNT
$ !
$       IF RM_CNT .EQ. Ø THEN GOTO JUMP_STATUS
$       CNT = 1
$       WRITE OUTFILE " THE FOLLOWING PLAYERS HAVE BEEN REMOVED:"
$   STATUS_LOOP7:
$       READ STATUS_FILE RMPLAYER
$       WRITE OUTFILE " ''CNT'.  ''RMPLAYER'"
$       CNT = CNT + 1
$       IF CNT .LE. RM_CNT THEN GOTO STATUS_LOOP7
$   JUMP_STATUS:
$ !
$   CLOSE STATUS_FILE
$   CLOSE OUTFILE
$   TYPE STATUS.DAT
$ !
$   GOTO MENU
$ !
$  ENTRY1:
$ !
$  TYPE SYS$INPUT

        THIS PORTION OF THE PROGRAM WILL ALLOW THE
        CONTROLLER TO:

                1.  DESIGN THE ORGANIZATIONAL STRUCTURE FOR THE GAME

                2.  DESIGN THE COMM NET SUPPORTING THE ORGANIZATION

$  INQUIRE LPLAYCNT "HOW MANY PLAYERS, INCLUDING THE CONTROLLER, ARE THERE?"
$  IF LPLAYCNT .LES. "Ø" .OR. LPLAYCNT .GES. "99999" THEN GOTO MENU
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO STATUS_LOOP3
$ !
$ !
$       WRITE OUTFILE " "
$       WRITE OUTFILE " "
$ !
$       CNT = 1
$   STATUS_LOOP4:
$ !
$       READ STATUS_FILE RATE
$       WRITE OUTFILE " LOSS RATE FOR CIRCUIT ''CNT' -----> ''RATE'%"
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO STATUS_LOOP4
$ !
$ !
$       WRITE OUTFILE " "
$       WRITE OUTFILE " "
$ !
$       CNT = 1
$   STATUS_LOOP5:
$ !
$       READ STATUS_FILE RATE
$       WRITE OUTFILE " GARBLE RATE FOR CIRCUIT ''CNT' -----> ''RATE'%"
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO STATUS_LOOP5
$ !
$ !
$       WRITE OUTFILE " "
$       WRITE OUTFILE " "
$ !
$       CNT = 1
$   STATUS_LOOP6:
$ !
$       READ STATUS_FILE RATE
$   STATUS_LOOP1:
$        IF CNT .EQ. KNT THEN GOTO STAT_SKIP
$ !
$        READ STATUS_FILE LINK
$        WRITE OUTFILE " LINK''CNT'TO''KNT' ------> ''LINK'"
$ !
$   STAT_SKIP:
$        KNT = KNT+1
$        IF KNT .LE. STAT_CNT THEN GOTO STATUS_LOOP1
$        KNT = 1
$        CNT = CNT +1
$        IF CNT .LE. STAT_CNT THEN GOTO STATUS_LOOP1
$ !
$   CLOSE STATUS_FILE
$   OPEN/READ STATUS_FILE [CLARK]PARAMETER.DAT
$ !
$        WRITE OUTFILE " "
$        WRITE OUTFILE " "
$ !
$        CNT = 1
$   STATUS_LOOP2:
$ !
$        READ STATUS_FILE RATE
$        WRITE OUTFILE " ARRIVAL RATE FOR CIRCUIT ''CNT' -----> ''RATE'"
$        CNT = CNT + 1
$        IF CNT .LE. 5 THEN GOTO STATUS_LOOP2
$ !
$        WRITE OUTFILE " "
$        WRITE OUTFILE " "
$ !
$        CNT = 1
$   STATUS_LOOP3:
$ !
$        READ STATUS_FILE RATE
$        WRITE OUTFILE " SERVICE RATE FOR CIRCUIT ''CNT' -----> ''RATE'"
$       GOTO ENTRY2
$  !
$   SET_SVC_RATE_3:
$       SERVICE_RATE1 := 9.3Ø
$       SERVICE_RATE2 := 9.15
$       SERVICE_RATE3 := 9.12
$       SERVICE_RATE4 := 9.Ø9
$       SERVICE_RATE5 := 9.Ø6
$  !
$       GOTO ENTRY2
$  !
$********************************************************************************
$  !
$   SET_PARAMETER_2:
$  !
$       TYPE SYS$INPUT

        ENTER THE 'PROBABILITY' THAT A MESSAGES WILL
        BE "GARBLED" DURING TRANSMISSION. FIVE EQUALS
        FIVE PERCENT.  USE INTEGER VALUES.

        TYPE "1" IF YOU WISH TO ENTER A SEPARATE PROBABILITY
        FOR EACH CIRCUIT TYPE. (1-5)

        TYPE '2' IF YOU WANT A STANDARD PROBABILITY FOR ALL
        CIRCUITS.

        NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
        CURRENTLY SET -- TYPE <CR>


        ENTER THE  MESSAGE GARBLE PROBABILITY FOR EACH CURCUIT

        FOR CIRCUIT TYPE [ ]:
```

```
$ !
$       INQUIRE NORM_MED_HEAVY  " NORMAL, MEDIUM OR HEAVY "
$       IF NORM_MED_HEAVY .EQS. "NORMAL" THEN A := 1.Ø
$       IF NORM_MED_HEAVY .EQS. "MEDIUM" THEN A := 2.Ø
$       IF NORM_MED_HEAVY .EQS. "HEAVY" THEN A := 3.Ø
$ !
$       ARRIVAL_RATE1 := 'A'
$       ARRIVAL_RATE2 := 'A'
$       ARRIVAL_RATE3 := 'A'
$       ARRIVAL_RATE4 := 'A'
$       ARRIVAL_RATE5 := 'A'
$ !
$       IF A .EQS. "1.Ø" THEN GOTO SET_SVC_RATE_1
$       IF A .EQS. "2.Ø" THEN GOTO SET_SVC_RATE_2
$       IF A .EQS. "3.Ø" THEN GOTC SET_SVC_RATE_3
$ !
$       GOTO ENTRY2
$ !
$  SET_SVC_RATE_1:
$       SERVICE_RATE1 := 3.1Ø
$       SERVICE_RATE2 := 3.Ø5
$       SERVICE_RATE3 := 3.Ø4
$       SERVICE_RATE4 := 3.Ø3
$       SERVICE_RATE5 := 3.Ø2
$ !
$       GOTO ENTRY2
$ !
$  SET_SVC_RATE_2:
$       SERVICE_RATE1 := 6.2Ø
$       SERVICE_RATE2 := 6.1Ø
$       SERVICE_RATE3 :- 6.Ø8
$       SERVICE_RATE4 := 6.Ø6
$       SERVICE_RATE5 := 6.Ø2
$ !
$ !
$       CNT = 1
$   LOOP4:
$       WRITE SYS$OUTPUT "FOR CIRCUIT TYPE [ ''CNT' ]"
$       INQUIRE/NOPUNCTUATION ARRIVAL_RATE'CNT' "ARRIVAL RATE = "
$       INQUIRE/NOPUNCTUATION SERVICE_RATE'CNT' "SERVICE RATE = "
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO LOOP4
$ !
$  INQUIRE NULL " RETURN TO MODIFY MENU BY DEPRESSING <CR> "
$   GOTO ENTRY2
$ !
$  ENTRY4:
$       TYPE SYS$INPUT

        THE PRE-ESTABLISHED RELATIONSHIP BETWEEN ARRIVAL
        AND SERVICE RATES FOR A NORMAL ARRIVAL RATE IS
        AS FOLLOWS:

                FOR CIRCUIT TYPE 1: S = 3.10ØA

                FOR CIRCUIT TYPE 2: S = 3.Ø5A

                FOR CIRCUIT TYPE 3: S = 3.Ø4A

                FOR CIRCUIT TYPE 4: S = 3.Ø3A

                FOR CIRCUIT TYPE 5: S = 3.Ø2A

        ENTER "NORMAL", "MEDIUM" OR "HEAVY" TO ESTABLISH
        THE INITIAL MESSAGE ARRIVAL RATES.


        CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
        THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY".
```

```
          VARY ONLY THE MESSAGE ARRIVAL RATE BY REQUESTING:

                    A.  NORMAL TRAFFIC
                    B.  MEDIUM TRAFFIC (TWICE THE NORMAL ARRIVAL
                        RATE)
                    C.  HEAVY TRAFFIC (THREE TIMES THE NORMAL RATE)


          TYPE "1" TO INSERT SPECIFIC ARRIVAL AND SERVICE RATES.

          TYPE "2" TC USE THE GENERAL RATES (NORMAL, MEDIUM, HEAVY)

          NOTE:  IF YOU DO NOT WISH TO CHANGE VAIUES CURRENTLY
                 SET -- TYPE <CR>.

$         INQUIRE ANSWER " ENTER 1, 2, OR <CR> "
$ !
$         IF ANSWER .EQS."1" THEN GOTO ENTRY3
$         IF ANSWER .EQS."2" THEN GOTO ENTRY4
$         IF ANSWER .ECS."" THEN GOTO ENTRY2
$ !
$         GOTO SET_PARAMETER_1
$ !
$ !
$      ENTRY3:
$         TYPE SYS$INPUT

          TO AVOID A QUEUE WHICH GROWS WITHCUT BOUND, INSURE
          A/S < 1

          NOTE:  MESSAGE RATES ARE IN NUMBERS OF MESSAGFS PER
                 MINUTE.  USE REAL NUMBERS 99.99 OR LESS.

          SPECIFIC RATES:
```

```
        1 -- ENCRYPTED LANDLINE (AUTODIN)
        2 -- NON-ENCRYPTED LANDLINE (TELETYPE)
        3 -- DIGITAL RF CIRCUIT (HF/VHF/UHF) WITH A/J
        4 -- DIGITAL RF CIRCUIT WITHOUT A/J PROTECTION
        5 -- VOICE (TELEPHONE)
        6 -- PERFECT LINK (NO DELAY, NO DEGRADATION)

$ !
$   WRITE SYS$OUTPUT "123456     THE CURRENT LINK CODE IS : "
$   WRITE SYS$OUTPUT LINK'INDEX1'TO'INDEX2'
$   WRITE SYS$OUTPUT " "
$ !
$   INQUIRE LINK'INDEX1'TO'INDEX2' "ENTER NEW LINK CODE"
$ !
$   LINK_CODE_CHANGED := "YES"  ! LINK CODE CHANGE FLAG
$ !
$   GOTO ENTRY2
$ !
$   SET_PARAMETER_1:
$ !
$       TYPE SYS$INPUT

        BASED ON THE QUEUING ALGORITHM FOR SINGLE SERVER
        FACILITIES THE AVERAGE AMOUNT OF TRANMISSION DELAY
        FOR MESSAGES ADDRESSED TO A GIVEN FACILITY (WQ)
        CAN BE EXPRESSED AS A FUNCTION OF THE AVERAGE
        MESSAGE ARRIVAL RATE (A) AND THE AVERAGE MESSAGE
        SERVICE RATE (S).

                WQ = A/S(S-A)

        YOU MAY SPECIFY THE ACTUAL ARRIVAL RATES AND
        SERVICE RATES FOR EACH CLASS OF COMMUNICATIONS
        (1 THROUGH 5) OR YOU MAY RELY UPON A PRE-ESTABLISHED
        SERVICE RATE AND ARRIVAL RATE RELATIONSHIP AND
```

```
$ !
$       CNT = 1
$       INDEX1 = Ø
$       INDEX2 = Ø
$ !
$  CHG_LINK_LOOP:
$ !
$       IF CHG_NAME1 .EQS. PLAYER'CNT' THEN INDEX1 = 'CNT'
$       IF CHG_NAME2 .EQS. PLAYER'CNT' THEN INDEX2 = 'CNT'
$       IF INDEX1 .NE. Ø .AND. INDEX2 .NE. Ø THEN GOTO OVER_CHG
$       CNT = CNT + 1
$       IF CNT .GT. 'PLAYCNT' THEN GOTO INVALID_PLAYER_NAME
$       GOTO CHG_LINK_LOOP
$ !
$   INVALID_PLAYER_NAME:
$ !
$   TYPE SYS$INPUT

    ********* INVALID PLAYER NAME USED *********

$   IF INDEX1 .EQ. Ø THEN WRITE SYS$OUTPUT "                ''CHG_NAME1'"
$   IF INDEX2 .EQ. Ø THEN WRITE SYS$OUTPUT "                ''CHG_NAME2'"
$ !
$   GOTO ENTRY2
$ !
$   OVER_CHG:
$ !
$  TYPE SYS$INPUT

        ENTER A SIX DIGIT NUMBER CONSISTING OF Ø's AND 1's
        TO INDICATE CIRCUIT AVAILABILITY BETWEEN PLAYER PAIRS
        IN THE POSITIONAL ORDER SHOWN BELOW (I.E., 1ØØØ1Ø
        REPRESENTS AN ENCRYPTED LANDLINE AND A VOICE CIRCUIT).
```

```
                5.  REMOVE PLAYERS FROM THE GAME.

                6.  RETURN TO MAIN MENU. (GAME UNCHANGED, STATUS DISPLAYED)

        #       7.  IMPLEMENT CHANGES AND RETURN TO MAIN MENU.
                       (STATUS DISPLAYED)

      #NOTE#:  CHANGES DO NOT BECOME EFFECTIVE UNTIL ITEM #7
               IS REQUESTED.  THIS ALLOWS YOU TO RECOVER BY SIMPLY
               RETURNING TO THE MAIN MENU (ITEM #6)


$       INQUIRE PARAM "ENTER Ø,1,2,3,4,5,6 OR 7 "
$               IF PARAM .EQS. "Ø" THEN GOTO SET_PARAMETER_Ø
$               IF PARAM .EQS. "1" THEN GOTO SET_PARAMETER_1
$               IF PARAM .EQS. "2" THEN GOTO SET_PARAMETER_2
$               IF PARAM .EQS. "3" THEN GOTO SET_PARAMETER_3
$               IF PARAM .EQS. "4" THEN GOTO SET_PARAMETER_4
$               IF PARAM .EQS. "5" THEN GOTO SET_PARAMETER_5
$               IF PARAM .EQS. "6" THEN GOTO GAME_STATUS
$               IF PARAM .EQS. "7" THEN GOTO SAVE_MODIFICATIONS
$ !
$   GOTO ENTRY2
$ !
$   SET_PARAMETER_Ø:
$ !
$       TYPE SYS$INPUT

        YOU WISH TO CHANGE THE COMUNICATION LINK CODE BETWEEN
        TWO GAME PLAYERS.

$   INQUIRE CHG_NAME1 "CHANGE LINK CODE FROM PLAYER (NAME)"
$   INQUIRE CHG_NAME2 "TO PLAYER"
$ !
$ ! DETERMINE THE LINKCODE
$       KNT = KNT + 1
$       IF KNT .LE. PLAYCNT THEN GOTO LOOP3
$       KNT = 1
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO LOOP3
$ !
$       CLOSE OUTFILE
$       CLOSE OUTFIL3
$ !
$       APPEND DRA0:[CLARK]DOC.SRT,DRA0:[CLARK]DATA2.TMP,DRA0:
        [CLARK]DATA1.TMP DOCUMEN
$ !
$       INQUIRE NULL " RETURN TO MAIN MENU BY DEPRESSING <CR> "
$  GOTO MENU
$ !
$  ENTRY2:
$ !
$       TYPE SYS$INPUT

        PARAMETER INIALIZATION AND MODIFICATION SUBROUTINE

        THIS PORTION OF THE PROGRAM ALLOWS THE CONTROLLER TO:


                  0.  CHANGE COMMUNICATION LINK BETWEEN TWO PLAYERS.

                  1.  SET MESSAGE ARRIVAL AND SERVICE RATES TO BE USED
                      FOR EACH TYPE LINK.

                  2.  SET PROBABILITY OF MESSAGE GARBLING.

                  3.  SET MESSAGE LOSS RATES FOR EACH CIRCUIT TYPE.

                  4.  SET RATE OF MESSAGE GARBLING.
```

```
                   PROBABILITY =

              OR:

            ENTER THE STANDARD PROBABILITY FOR ALL CIRCUITS

                   PROBABILITY =

            CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
            THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY"

$ !
$           INQUIRE ANSWER " ENTER 1, 2, OR <CR> "
$ !
$           IF ANSWER .EQS. "1" THEN GOTO ENTRY21
$           IF ANSWER .EQS. "2" THEN GOTO ENTRY22
$           IF ANSWER .EQS. "" THEN GOTO ENTRY2
$ !
$       ENTRY21:
$           CNT = 1
$           TYPE SYS$INPUT
            ENTER THE MESSAGE GARBLE PROBABILITY FOR EACH CIRCUIT

$       PCKT_LOOP:
$           WRITE SYS$OUTPUT " FOR CIRCUIT TYPE [ ''CNT' ]:"
$           INQUIRE/NOPUNCTUATION PGARB'CNT' "PROBABILITY = "
$           CNT = CNT + 1
$           IF CNT .LE. 5 THEN GOTO PCKT_LOOP
$ !
$           GOTO ENTRY2
$ !
$ !
$       ENTRY22:
$           TYPE SYS$INPUT
```

```
         ENTER THE STANDARD PROBABILITY FOR ALL CIRCUITS

$        INQUIRE/NOPUNCTUATION PGARB " PROBABILITY = "
$ !
$        CNT = 1
$    PGARB_LOOP:
$        PGARB'CNT' := 'PGARB'
$        CNT = CNT + 1
$        IF CNT .LE. 5 THEN GOTO PGARB_LOOP
$ !
$        GOTO ENTRY2
$ !
$ !
$ !
$    SET_PARAMETER_3:
$ !
$        TYPE SYS$INPUT

         ENTER THE RATE FOR MESSAGES TO BE "LOST."  FIVE
         EQUALS FIVE PERCENT.  USE INTEGER VALUES.

         ENTER "1" IF YOU WISH TO ENTER A SEPARATE LOSS
         RATE FOR EACH CIRCUIT TYPE. (1-5)

         ENTER "2" IF YOU WANT A STANDARD RATE FOR ALL
         CIRCUITS.

         NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
         CURRENTLY SET -- TYPE <CR>


         ENTER THE LOSS RATE BY COMM CIRCUIT TYPE FOR
         CIRCUIT TYPE [ ]:

                 LOSS RATE =
         OR:

       ENTER THE STANDARD RATE FOR ALL CIRCUITS

               LOSS RATE =

       CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
       THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY"

$ !
$      INQUIRE ANSWER " ENTER 1, 2, OR <CR> "
$ !
$      IF ANSWER .EQS. "1" THEN GOTO ENTRY6
$      IF ANSWER .EQS. "2" THEN GOTO ENTRY7
$ !
$      GOTO ENTRY2
$ !
$   ENTRY6:
$      CNT = 1
$   LOOP5:
$      WRITE SYS$OUTPUT "ENTER THE LOSS RATES FOR COMM CIRCUIT TYPE [ ''CNT' ]"
$      INQUIRE/NOPUNCTUATION LOSS_RATE'CNT' "LOSS RATE = "
$      CNT = CNT + 1
$      IF CNT .LE. 5 THEN GOTO LOOP5
$ !
$      GOTO ENTRY2
$ !
$   ENTRY7:
$      TYPE SYS$INPUT

       ENTER THE STANDARD LOSSRATE

$      INQUIRE/NOPUNCTUATION LOSSRATE " LOSS RATE = "
$ !
$       CNT = 1
$   LOSS_LOOP:
$       LOSS_RATE'CNT' := 'LOSSRATE'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO LOSS_LOOP
$ !
$       GOTO ENTRY2
$ !
$   ENTRY6:
$ !
$       INQUIRE NULL "_ENTER <CR> TO CONTINUE OR 1 FOR MAIN MENU "
$       IF NULL .EQS. "1" THEN GOTO MENU
$ !
$   SET_PARAMETER_4:
$ !
$       TYPE SYS$INPUT

        ENTER THE RATE AT WHICH YOU WISH MESSAGES TO BE
        "GARBLED" DURING TRANSMISSION. FIVE EQUALS FIVE
        EQUALS FIVE PERCENT.  USE INTEGER VALUES.

        TYPE "1" IF YOU WISH TO ENTER A SEPARATE RATE
        FOR EACH CIRCUIT TYPE. (1-5)

        TYPE "2" IF YOU WANT A STANDARD RATE FOR ALL
        CIRCUITS.

        NOTE:  IF YOU DO NOT WISH TO CHANGE VALUES
        CURRENTLY SET -- TYPE <CR>


        ENTER THE MESSAGE GARBLE RATE FOR EACH CURCUIT

        FOR CIRCUIT TYPE 'J:
             RATE =

          OR:

        ENTER THE STANDARD RATE FOR ALL CIRCUITS

             RATE =

        CHANGES TO THESE VALUES WHICH ARE DESIRED DURING
        THE GAME SHOULD BE MADE BY RE-ENTERING "MODIFY"

$ !
        INQUIRE ANSWER " ENTER 1, 2, OR <CR> "
$ !
        IF ANSWER .EQS. "1" THEN GOTO ENTRY9
        IF ANSWER .EQS. "2" THEN GOTO ENTRY1Ø
        IF ANSWER .EQS. "" THEN GOTO ENTRY2
$ !
$   ENTRY9:
$       CNT = 1
$       TYPE SYS$INPUT
        ENTER THE MESSAGE GARBLE RATE FOR EACH CIRCUIT

$   CKT_LOOP:
$       WRITE SYS$OUTPUT " FOR CIRCUIT TYPE [ ''CNT' ]:"
$       INQUIRE/NOPUNCTUATION GARBLE_RATE'CNT' "RATE = "
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO CKT_LOOP
$ !
$       GOTO ENTRY2
$ !
$ !
$   ENTRY1Ø:
$       TYPE SYS$INPUT
```

```
        ENTER THE STANDARD RATE FOR ALL CIRCUITS

$       INQUIRE/NOPUNCTUATION GARBRATE " RATE = "
$ !
$       CNT = 1
$   GARB_LOOP:
$       GARBLE_RATE'CNT' := 'GARBRATE'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO GARB_LOOP
$ !
$       GOTO ENTRY2
$ !
$  SET_PARAMETER_5:
$ !
$   ENTRY11:
$ !
$       TYPE SYS$INPUT

        ENTER THE NUMBER OF PLAYERS AND THE NAME OF EACH
        PLAYER WHO HAS BEEN "DESTROYED" OR WHO FOR SOME
        REASON IS TO BE REMOVED FROM THE GAME AFTER GAME
        START.  ENTER THE NUMBER AND A <CR> AND THE NAME
        OF EACH PLAYER WITH A <CR> FOLLOWING EACH NAME.

        NOTE:  IF YOU DO NOT WISH TO CHANGE THE VALUES
        CURRENTLY SET -- TYPE <CR>.

$       INQUIRE/NOPUNCTUATION RMPLAYERCNT -
                "NUMBER OF PLAYER(S) TO BE REMOVED = "
$ !
$       IF RMPLAYERCNT .EQS. "" THEN GOTO ENTRY2
$       RM_PLAYER_CNT := 'RMPLAYERCNT'
$       IF RM_PLAYER_CNT .EQ. 0 THEN GOTO ENTRY2
$ !
$       CNT = 1
$  LOOP6:
$       INQUIRE NAME -
                  "PLAYER NAME "
$       RM_PLAYER_NAME'CNT' := 'NAME'
$                 WRITE SYS$OUTPUT " REMOVED PLAYER IS: ''NAME'"
$       CNT = CNT + 1
$       IF CNT .LE. RMPLAYERCNT THEN GOTO LOOP6
$ !
$       GOTO ENTRY2
$ !
$ !
$ !     THIS IS THE END OF THE MODIFY PORTION OF WARGAME.
$ !
$  MENU:
$       TYPE SYS$INPUT

        WHAT PORTION OF THE WARGAME DO YOU WISH TO ACCESS?

                  BUILD (B)
                  MODIFY (M)
                  PLAY (P)
                  INITIATE MTM (I)
                  STATUS (S)
                  QUIT (Q)

$ GOTO LOOP1
$ !
$  SETVAL:
$ !
$ !     THIS SECTION ENABIES ALI CURCUIT IINK VALUES
$ !     AND STORES THE VALUE IN LINK<NUM>TC<NUM>
$ !
$ !
$ !
$ CNT = 1
$  KNT = 1
$       OPEN/WRITE OUTFILE DRAØ:[CLARK]DATA1.TMP
$   LOOP7:
$       IF CNT .EQ. KNT THEN GOTO SKIP3
$ !
$       LINK'CNT'TO'KNT'   =  "111111"
$       WRITE OUTFILE "LINK''CNT'TO''KNT'   =  111111"
$       WRITE OUTFIL3 "111111"
$ !
$   SKIP3:
$       KNT = KNT + 1
$       IF KNT .LE. PLAYCNT THEN GOTO LOOP7
$       KNT = 1
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO LOOP7
$ !
$       CLOSE OUTFILE
$       CLOSE OUTFIL3
$ !
$       APPEND DRAØ:[CLARK]DOC.SRT,DRAØ:[CLARK]DATA2.TMP,DRAØ:
        [CLARK]DATA1.TMP DOCUMEN
$ !
$       INQUIRE NULL " RETURN TO MAIN MENU BY DEPRESSING <CR> "
$  GOTO MENU
$ !
$   SAVE_MODIFICATIONS:
$ !
$ ! ***********************************************************************
$       OPEN/WRITE OUTFILE DRAØ:[CLARK]PARAMETER.DAT
$ !
$       WRITE OUTFILE "''ARRIVAL_RATE1'"
$       WRITE OUTFILE "''ARRIVAL_RATE2'"
$       WRITE OUTFILE "''ARRIVAL_RATE3'"
$       WRITE OUTFILE "''ARRIVAL_RATE4'"
$       WRITE OUTFILE "''ARRIVAL_RATE5'"
$ !
$ LOOP4:
$ TYPE SYS$INPUT

    ENTER SELECTION:

                1.  SEND ANOTHER MESSAGE
                2.  RETURN TO COMMAND LEVEL
                3.  QUIT THE GAME

$ INQUIRE SELECTION " ENTER SELECTION 1,2, OR 3  "
$ IF SELECTION .EQ. 1 THEN GOTO LOOP1
$ IF SELECTION .EQ. 2 THEN GOTO LOOP2
$ IF SELECTION .EQ. 3 THEN GOTO LOOP3
$ GOTO LOOP4
$ LOOP3:
$ STOPGAME :== YES
$ EXIT


*** RTCCC.COM ***

$  SET NOCONTROL_Y
$  SET NOVERIFY
$ !
$  COMM :== "DONE"
$ !
$ OPT := 4MAIL7SENDMSG7READMSG4QUIT4HELP
$ TYPE SYS$INPUT

        WELCOME TO THE TO THE NAVAL POSTGRADUATE SCHOOL C3 WARGAME

        HERE IS A LIST OF ALLOWABLE COMMANDS AND THEIR DEFINITIONS.

$ !
$ !
$ ! ********************************************************
$ !
$ ! ********************************************************
$ !
$ ! THE MESSAGE ARE NOW SUBMITTED TO THE BATCH SYSTEM TO BE
$ ! APPROPRIATELY DELAYED AND FORWARDED.
$ !
$ OPEN/READ INFILE MSGOUT.TXT
$ CNT = 1
$ !
$   SUBMIT_MORE:
$ !
$  GLOBAL_CNT == 'GLOBAL_CNT' + 1
$  IF GLOBAL_CNT .GE. 999 THEN GLOBAL_CNT == 1
$ !
$ READ/END_OF_FILE=FINISH INFILE TO_PLAYER
$ READ/END_OF_FILE=FINISH INFILE MSG_FILE
$ READ/END_OF_FILE=FINISH INFILE DELAY_TIME
$ !
$ !
$ SUBMIT/NOIDENTITY DRA0:[CLARK.CCC]SENDMSG.COM -
  /PARAMETERS=("''SUBJ'","''MSG_FILE'","''TO_PLAYER'", -
  "''FROM'","''DELAY_TIME'",'GLOBAL_CNT',"''TO'",'CIRCUIT_TYPE')
$ !
$ !
$  CNT = CNT + 1  ! INCREMENT FILE VERSION NUMBER
$ GOTO SUBMIT_MORE
$ !
$  FINISH:
$ !
$  CLOSE INFILE
$ !
$ ! **************************************************************
$ !
```

```
        4 -- DIGITAL RF CIRCUIT WITHOUT A/J PROTECTION
        5 -- VOICE (TELEPHONE)

$ !
$ GOTO FIND_CIRCUIT_TYPE
$ !
$   SKIP_TYPE:
$ !
$ ! TEST FOR NUMERIC CIRCUIT TYPE.
$ IF CIRCUIT_TYPE .LT. Ø .OR. CIRCUIT_TYPE .GT. 7 THEN GOTO FIND_CIRCUIT_TYPE
$ !
$ !   ************************************************************
$ !
$ !   ************************************************************
$ !++
$ ! mail.com
$ !
$ !
$ ! This procedure prompts for mailing information, invokes edt to allow
$ ! you to edit your text.
$ ! ALSO, this procedure initiates a subprocess to scramble
$ ! the message, delay the message according to its message path and
$ ! send the message on its way using the mail utility.
$ !
$ !--
$ !   EDIT MESSAGE TEXT BY INVOKING THE EDITOR.
$ !
$ !
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ edit/edt DRAØ:[CLARK.CCC]MSG.TXT /O=message.txt
$ !
$ @DRAØ:[CLARK.CCC]CKMSG.COM
$ !
$ IF SEVERITY .EQ. 2 THEN GOTO LOOP4 !INACTIVE PLAYER OR MISSPELLED NAME
$ IF SEVERITY .EQ. 3 THEN GOTO LOOP4 !NO ADDRESSEE.  SEND NO MESSAGE
$ IF COMM .EQS. "DONE" THEN GOTO LOOP2
$ !
$ IF INIMAIL .EQS. "YES" THEN @DRA0:[CLARK.CCC]ACTMAIL
$ IF INIMAIL .EQS. "DONE" THEN GOTO LOOP2
$ !
$ IF MTM_HELP .EQS. "YES" THEN @DRA0:[CLARK.CCC]MTMHELP
$ IF MTM_HELP .EQS. "DONE" THEN GOTO LOOP2
$ !
$ LOOP1:
$ SENDMSG :== "NO"
$ !
$ !  TEST FOR USER REQUEST FOR GAME TERMINATION.
$ !
$ IF STOPGAME .EQS. "YES" THEN EXIT
$ !
$ !  REQUEST MESSAGE PARAMETERS
$ !
$ INQUIRE/GLOBAL TO
$ INQUIRE/GLOBAL FROM
$ INQUIRE/GLOBAL SUBJ
$ !
$ FIND_CIRCUIT_TYPE:
$ !
$ INQUIRE/GLOBAL CIRCUIT_TYPE "SELECT CIRCUIT TYPE 0,1,2,3,4,5,6 OR ?"
$ !
$ IF CIRCUIT_TYPE .NES. "?" THEN GOTO SKIP_TYPE
$  TYPE SYS$INPUT

        CIRCUIT TYPES ARE DESCRIBED BELOW:

        0 -- FIRST AVAILABLE CIRCUIT IN THE ORDER LISTED BELOW
        6 -- PERFECT LINK (NO DELAY, NO DEGRADATION)
        1 -- ENCRYPTED LANDLINE (AUTODIN)
        2 -- NON-ENCRYPTED LANDLINE (TELETYPE)
        3 -- DIGITAL RF CIRCUIT (HF/VHF/UHF) WITH A/J
```

```
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ RUN DRAØ:[CLARK.INOUTP]INOUTP
$ !
$ !  TEST FOR THE BRANCH VALUE.  THE FLAGS ARE SET IN THE
$ !  INPUT/OUTPUT PROGRAM (A FORTRAN PROGRAM) BY THE USE
$ !  OF THE LIB$DO SYSTEM CALL.
$ !
$ IF COMM .EQS. "YES" THEN @DRAØ:[CLARK.CCC]RTCCC
$ IF COMM .EQS. "DONE" THEN GOTO LOOP2
$ !
$ !
$ IF INIMAIL .EQS. "YES" THEN @DRAØ:[CLARK.CCC]ACTMAIL
$ IF INIMAIL .EQS. "DONE" THEN GOTO LOOP2
$ !
$ IF MTM_HELP .EQS. "YES" THEN @DRAØ:[CLARK.CCC]MTMHELP
$ IF MTM_HELP .EQS. "DONE" THEN GOTO LOOP2
$ !
$ GOTO LOOP1
$ LOOP2:
$ !
$ ! RESET FLAGS TO NO AFTER EXECUTION OF EITHER SUBPROGRAM.
$ !
$ INIMAIL :== "NO"
$ MTM_HELP :== "NO"
$ COMM :== "NO"
$ !
$ !  SEE DESCRIPTION OF INOUTP ABOVE
$ !
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ RUN DRAØ:[CLARK.INOUTP]INOUTP1
$ !
$ !  TEST FOR BRANCH FLAG.
$ !
$ !
$ IF COMM .EQS. "YES" THEN @DRAØ:[CLARK.CCC]RTCCC
$ !
$ !
$   ERROR1:
$       WRITE SYS$OUTPUT " *** THE VALUE IS NOT ACCEPTABLE *** "
$       GOTO LOOP3
```

```
*** RTSSS.COM ***

$ !SET NOVERIFY
$ !
$ !  CLEARING THE MESSAGE TO PARAMETER AND THE MESSAGE SUBJECT
$ !  PARAMETER TO ACCEPT NEW VALUES
$ !
$ TO :== ""
$ SUBJ :== ""
$ !
$ DELETE COLOR.DAT.*  ! FILE CONTAINS RED CR BLUE.  RESET IT.
$ !
$ !  ON FIRST ENTRY TO THIS DCL, I SET MY INITIATE MAIL, HELP AND
$ !  STOP GAME FLAGS TO NO.  THESE FLAGS ARE USED TO BRANCH
$ !  TO THE APPROPRIATE SECTION OF THIS DCL
$ !
$ COMM :== "NO"
$ INIMAIL :== "NO"
$ MTM_HELP :== "NO"
$ STOPGAME :== "NO"
$ !
$ !  INOUTP OR THE INPUT/OUTPUT PROGRAM IS THE COMMUNICATION
$ !  INTERFACE TO THE MCCLINTIC THEATER MODEL.  INOUTP IS
$ !  EXECUTED ONLY ONCE (THE FIRST TIME A PLAYER ENTERS THE
$ !  GAME.  ALL SUBSEQUENT ENTRIES ARE EXECUTED IN INOUTP1
$ !  WHICH IS A MODIFIED VERSION OF THE ORIGINAL INPUT/OUTPUT
$ !  PROGRAM.
$ !
$ !
$       CLOSE OUTFILE
$ !
$ !
$   IF LINK_CODE_CHANGED .NES. "YES" THEN GOTO GAME_STATUS
$ !
$       OPEN/WRITE OUTFILE3 DRA0:[CLARK]INTERFACE.DAT
$       WRITE OUTFILE3 PLAYCNT
$       CNT = 1
$   SAV_LOOP6:
$       WRITE OUTFILE3 PLAYER'CNT'
$       WRITE OUTFILE3 DIRECTORY_NAME'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO SAV_LOOP6
$ !
$  CNT = 1
$  KNT = 1
$  SAV_LOOP7:
$       IF CNT .EQ. KNT THEN GOTO SAV_SKIP3
$ !
$       WRITE OUTFILE3 LINK'CNT'TO'KNT'
$ !
$   SAV_SKIP3:
$       KNT = KNT + 1
$       IF KNT .LE. PLAYCNT THEN GOTO SAV_LOOP7
$       KNT = 1
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO SAV_LOOP7
$ !
$       CLOSE OUTFILE3
$ !
$   LINK_CODE_CHANGED := "NO" ! RESET FLAG
$ !
$       GOTO GAME_STATUS
$ !
$ !
$        WRITE OUTFILE "''SERVICE_RATE1'"
$        WRITE OUTFILE "''SERVICE_RATE2'"
$        WRITE OUTFILE "''SERVICE_RATE3'"
$        WRITE OUTFILE "''SERVICE_RATE4'"
$        WRITE OUTFILE "''SERVICE_RATE5'"
$ !
$        WRITE OUTFILE "''LOSS_RATE1'"
$        WRITE OUTFILE "''LOSS_RATE2'"
$        WRITE OUTFILE "''LOSS_RATE3'"
$        WRITE OUTFILE "''LOSS_RATE4'"
$        WRITE OUTFILE "''LOSS_RATE5'"
$ !
$        WRITE OUTFILE "''GARBLE_RATE1'"
$        WRITE OUTFILE "''GARBLE_RATE2'"
$        WRITE OUTFILE "''GARBLE_RATE3'"
$        WRITE OUTFILE "''GARBLE_RATE4'"
$        WRITE OUTFILE "''GARBLE_RATE5'"
$ !
$        WRITE OUTFILE "''PGARB1'"
$        WRITE OUTFILE "''PGARB2'"
$        WRITE OUTFILE "''PGARB3'"
$        WRITE OUTFILE "''PGARB4'"
$        WRITE OUTFILE "''PGARB5'"
$ !
$        WRITE OUTFILE "''RM_PLAYER_CNT'"
$ !
$        IF RM PLAYER_CNT .EQ. 0 THEN GOTO OVER5
$        CNT = 1
$    OUTLOOP5:
$        WRITE OUTFILE RM_PLAYER_NAME'CNT'
$        CNT = CNT + 1
$        IF CNT .LE. RM_PLAYER_CNT THEN GOTO OUTLOOP5
$ !
$    OVER5:
```

```
$ GOTO SUBMIT_MORE
$ !
$  FINISH:
$ !
$ CLOSE INFILE
$ !
$ GOTO NEXT
$ !
$ QUITØ:
$ EXIT
```

*** ACTMAIL.COM ***

```
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ MAIL
$ INIMAIL :== "DONE"
$ EXIT
```

*** MTMHELP ***

```
$  SET NOCONTROL_Y
$!  SET NOVERIFY
$ !
$  MTM_HELP :== "DONE"
$ !
$ CPT := 3AIR7AIRLIFT6CANCEL3DCA7DESTROY6ESCORT4FIRE5INTEL6LOGREP4MINE-
4MOVE8RESUPPLY7SEALIFT4SEND6SITREP9THRESHOLD4TIME4HELP4DONE4COMM
$ TYPE SYS$INPUT

        WARGAME COMMAND INTERPRETER
```

```
$ ! Also, this procedure initiates a subprocess to scramble
$ ! the message, delay the message according to its message path and
$ ! send the message on its way using the mail utility.
$ !
$ !--
$ !   EDIT MESSAGE TEXT BY INVOKING THE EDITOR.
$ !
$ !
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ edit/edt DRA0:[CLARK.CCC]MSG.TXT /O=message.txt
$ !
$ @DRA0:[CLARK.CCC]CKMSG.COM
$ !
$ IF SEVERITY .EQ. 2 THEN GOTO NEXT  !INACTIVE PLAYER OR MISPELLED NAME
$ IF SEVERITY .EQ. 3 THEN GOTO NEXT  !NO ADDRESEE.  NO MESSAGE SENT.
$ !
$ OPEN/READ INFILE MSGOUT.TXT
$ CNT = 1
$   SUBMIT_MORE:
$ !
$  GLOBAL_CNT == 'GLOBAL_CNT' + 1
$  IF GLOBAL_CNT .GE. 999 THEN GLOBAL_CNT == 1
$ !
$ READ/END_OF_FILE=FINISH INFILE TO_PLAYER
$ READ/END_OF_FILE=FINISH INFILE MSG_FILE
$ READ/END_OF_FILE=FINISH INFILE DELAY_TIME
$ !
$ !
$ !
$ SUBMIT/NOIDENTIFY DRA0:[CLARK.CCC]SENDMSG.COM -
  /PARAMETERS=("''SUBJ'","''MSG_FILE'","''TO_PLAYER'", -
  "''FROM'","''DELAY_TIME'",'GLOBAL_CNT',"''TO'",'CIRCUIT_TYPE')
$ !
$ !
$  CNT = CNT + 1  ! INCREMENT FILE VERSION NUMBER
$ !
$ INQUIRE/GLOBAL TO
$ INQUIRE/GLOBAL FROM
$ INQUIRE/GLOBAL SUBJ
$ !
$ FIND_CIRCUIT_TYPE:
$ !
$ INQUIRE/GLOBAL CIRCUIT_TYPE "SELECT CIRCUIT TYPE Ø,1,2,3,4,5,6 OR ?"
$ !
$ IF CIRCUIT_TYPE .NES. "?" THEN GOTO SKIP_TYPE
$  TYPE SYS$INPUT

        CIRCUIT TYPES ARE DESCRIBED BELOW:

        Ø -- FIRST AVAILABLE CIRCUIT IN THE ORDER LISTED BELOW
        6 -- PERFECT LINK (NO DELAY, NO DEGRADATION)
        1 -- ENCRYPTED LANDLINE (AUTODIN)
        2 -- NON-ENCRYPTED LANDLINE (TELETYPE)
        3 -- DIGITAL RF CIRCUIT (HF/VHF/UHF) WITH A/J
        4 -- DIGITAL RF CIRCUIT WITHOUT A/J PROTECTION
        5 -- VOICE (TELEPHONE)
$ !
$ GOTO FIND_CIRCUIT_TYPE
$ !
$   SKIP_TYPE:
$ !
$ ! TEST FOR NUMERIC CIRCUIT TYPE.
$ IF CIRCUIT_TYPE .LT. Ø .OR. CIRCUIT_TYPE .GT. 7 THEN GOTO FIND_CIRCUIT_TYPE
$ !
$ !++
$ ! mail.com
$ !
$ !
$ ! This procedure prompts for mailing information, invoke edt to allow
$ ! you to edit your text.
$  CNT = 1
$  KNT = 1
$  INLOOP7:
$       IF CNT .EQ. KNT THEN GOTO INSKIP3
$ !
$       READ INFILE3 LINK
$       LINK'CNT'TO'KNT' :== "''LINK'"
$ !
$   INSKIP3:
$       KNT = KNT + 1
$       IF KNT .LE. PLAYCNT THEN GOTO INLOOP7
$       KNT = 1
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO INLOOP7
$ !
$  JUMP_LOOP2:
$       CLOSE INFILE3
$ !
$ !
$ ! **************************************************************
$ !
$ !  CLEARING THE MESSAGE TO PARAMETER AND THE MESSAGE SUBJECT
$ !  PARAMETER TO ACCEPT NEW VALUES
$ !
$ TO :== ""
$ SUBJ :== ""
$ !
$ TYPE SYS$INPUT   ! SKIP DOWN TWO LINES


$ !
$ !
$ LOOP1:
$ !
$ !  REQUEST MESSAGE PARAMETERS
$       CNT = 1
$   INLOOP4A:
$       READ INFILE PGARB'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP4A
$ !
$       READ INFILE RM_PLAYER_CNT
$ !
$       RM_PLAYER_CNT :== 'RM_PLAYER_CNT'
$ !
$       IF RM_PLAYER_CNT .EQ. Ø THEN GOTO JUMP5
$       CNT = 1
$   INLOOP5:
$       READ INFILE RM_PLAYER_NAME'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. RM_PLAYER_CNT THEN GOTO INLOOP5
$ !
$   JUMP5:
$  JUMP_LOOP1:
$ !
$       CLOSE INFILE
$ !
$ !
$       OPEN/READ/ERROR=JUMP_LOOP2 INFILE3 DRAØ:[CLARK]INTERFACE.DAT
$       READ/END_OF_FILE=JUMP_LOOP2 INFILE3 PLAYCNT
$       PLAYCNT :== 'PLAYCNT'
$       CNT = 1
$   INLOOP6:
$       READ INFILE3 NAME
$       PLAYER'CNT' :== "''NAME'"
$       READ INFILE3 RNAME
$       DIRECTORY_NAME'CNT' :== "''RNAME'"
$       CNT = CNT + 1
$       IF CNT .LE. PLAYCNT THEN GOTO INLOOP6
$ !
$ !  THIS SECTION READS THE CURRENT GAME STATUS WHICH MAY BE CHANGED
$ !  REAL-TIME BY THE CONTROLLER.  THIS SECTION RE-ESTABLISHES THE GAME
$ !  PARAMETERS AND INTERFACES.
$ !
$ !************************************************************
$ !
$   INITIAL:
$       CLOSE/ERROR=INITIAL1 INFILE
$   INITIAL1:
$       OPEN/READ/ERROR=JUMP_LOOP1 INFILE DRAØ:[CLARK]PARAMETER.DAT
$ !
$       CNT = 1
$   INLOOP1:
$       READ/END_OF_FILE=JUMP_LOOP1 INFILE ARRIVAL_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP1
$ !
$       CNT = 1
$   INLOOP2:
$       READ INFILE SERVICE_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP2
$ !
$       CNT = 1
$   INLOOP3:
$       READ INFILE LOSS_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP3
$ !
$       CNT = 1
$   INLOOP4:
$       READ INFILE GARBLE_RATE'CNT'
$       CNT = CNT + 1
$       IF CNT .LE. 5 THEN GOTO INLOOP4
$ !
$ !
$ INVALID_COMMAND:
$        WRITE SYS$OUTPUT " INVALID COMMAND"
$ !
$ HELPØ:
$        TYPE SYS$INPUT

         The commands you can enter are:

         MAIL              READ INCOMING MAIL
         SENDMSG           SEND A MESSAGE
         READMSG           READ ENTIRE MESSAGE FILE
         HELP              PRINTS THIS HELP MESSAGE
         QUIT              TO QUIT

         ENTER CTRL/Y      TO RESTART THIS SESSION
$ !
$ GOTO 'PROMPT'
$ !
$ MAILØ:
$ !
$ ASSIGN/USER_MODE SYS$COMMAND SYS$INPUT
$ MAIL
$ !
$ GOTC NEXT
$ READMSGØ:
$ !
$ TYPE MAIL.MAI
$ !
$ TYPE SYS$INPUT

$ GOTO NEXT
$ SENDMSGØ:
$ !
$ !
$ ! SET UP FOR INITIAL PROMPT
$ !
$ PROMPT := INITØ
$ GOTO HELPØ                              !PRINT INITIAL HELP MESSAGE
$ !
$ ! AFTER THE FIRST PROMPTING MESSAGE, USE THE PROMPT: NEXT
$ !
$ INITØ:
$ PROMPT := NEXT
$ !
$ ! MAIN COMMAND PARSING ROUTINE.  THE ROUTINE COMPARES THE CURRENT
$ ! COMMAND AGAINST THE OPTIONS IN THE OPTION TABLE.  WHEN IT FINDS
$ ! A MATCH, IT BRANCHES TO THE APPROPRIATE LABEL.
$ !
$ NEXT:
$       ON CONTROL_Y THEN GOTO NEXT    ! CTRL/Y RESTS PROMPT
$       SET CONTROL_Y
$       ON WARNING THEN GOTO NEXT      ! IF ANY, REST PROMPT
$ !
$       INQUIRE COMMAND "COMMANDER. WHAT IS YOUR COMMAND?"
$       IF COMMAND .EQS. "" THEN GOTO NEXT
$       COMMAND_SIZE = 'F$LENGTH(COMAND)'       !INPUT LENGTH
$       INDEX = Ø
$ !
$ CHECK_NEXT:
$       OPTION_LENGTH := 'F$EXTRACT(INDEX,1,OPT)'
$       IF OPTION_LENGTH .EQ. Ø THEN GOTO INVALID_COMMAND
$       IF OPTION_LENGTH .EQ. "" THEN GOTO INVALID_COMMAND
$       INDEX = INDEX + 1                        ! ADVANCE INDEX
$       NEXT_COMMAND := 'F$EXTRACT(INDEX,OPTION_LENGTH,OPT)'
$       'F$EXTRACT(Ø,COMMAND_SIZE,NEXT_COMMAND)
$       IF NEXT_COMMAND .EQS. "''COMMAND'" -
               THEN GOTO 'NEXT_COMMAND'Ø
$       INDEX = INDEX + OPTION_LENGTH            ! SET TO NEXT COMMAND
$       GOTO CHECK_NEXT
```

```
        ENTER THE COMMAND NAME WITH WHICH YOU REQUIRE A DEFINITION.

$ !
$ ! SET UP FOR INITIAL PROMPT
$ !
$ BRIEF := 'YES'
$ PROMPT := INITØ
$ GOTO HELPØ                              !PRINT INITIAL HELP MESSAGE
$ !
$ ! AFTER THE FIRST PROMPTING MESSAGE, USE THE PROMPT: NEXT
$ !
$ INITØ:
$ PROMPT := NEXT
$ !
$ ! MAIN COMMAND PARSING ROUTINE.  THE ROUTINE COMPARES THE CURRENT
$ ! COMMAND AGAINST THE OPTIONS IN THE OPTION TABLE.  WHEN IT FINDS
$ ! A MATCH, IT BRANCHES TO THE APPROPRIATE LABEL.
$ !
$ NEXT:
$       ON CONTROL_Y THEN GOTO NEXT     ! CTRL/Y RESTS PROMPT
$       SET CONTROL_Y
$       ON WARNING THEN GOTO NEXT       ! IF ANY, REST PROMPT
$ !
$       INQUIRE COMMAND "ENTER COMMAND"
$       IF COMMAND .EQS. "" THEN GOTO NEXT
$       IF COMMAND .EQS. "BRIEF" THEN BRIEF := "YES"
$       IF COMMAND .EQS. "VERBOSE" THEN BRIEF := "NO"
$       IF COMMAND .EQS. "BRIEF" THEN GOTO NEXT
$       IF COMMAND .EQS. "VERBOSE" THEN GOTO NEXT
$       COMMAND_SIZE = 'F$LENGTH(COMAND)'         !INPUT LENGTH
$       INDEX = Ø
$ !
$ CHECK_NEXT:
$       OPTION_LENGTH := 'F$EXTRACT(INDEX,1,OPT)'
$        IF OPTION_LENGTH .EQ. 0 THEN GOTO INVALID_COMMAND
$        IF OPTION_LENGTH .EQ. "" THEN GOTO INVALID_COMMAND
$        INDEX = INDEX + 1                            ! ADVANCE INDEX
$        NEXT_COMMAND := 'F$EXTRACT(INDEX,OPTION_LENGTH,OPT)'
$        'F$EXTRACT(0,COMMAND_SIZE,NEXT_COMMAND)
$        IF NEXT_COMMAND .EQS. "''COMMAND''" -
                 THEN GOTO 'NEXT_COMMAND'0
$        INDEX = INDEX + OPTION_LENGTH                ! SET TO NEXT COMMAND
$        GOTO CHECK_NEXT
$ !
$ INVALID_COMMAND:
$        WRITE SYS$OUTPUT " INVALID COMMAND"
$ !
$ HELP0:
$        TYPE SYS$INPUT

         The commands you can enter are:

         AIR               CAUSE AN AIR ATTACK ON A SPECIFIED HEX
         AIRLIFT           AIRLIFT A UNIT TO A SPECIFIED HEX
         CANCEL            CANCEL ORDERS TO A SPECIFIED UNIT
         COMM              SEND AND/OR READ MESSAGES ON COMMUNICATIONS NET
         DCA               ASSIGN AN UNIT TO DEFENSIVE COUNTER ALERT
         DESTROY           DESTROY ROADS,BRIDGES ETC. AT COORDINATES
         ESCORT            ASSIGN AIR ESCORT TO ANOTHER AIR UNIT
         FIRE              FIRE ON A DESIGNATED HEX COORDINATE
         INTEL             REQUEST INTELLIGENCE INFORMATION
         LOGREP            REQUEST A LOGISTICS REPORT
         MINE              IMPLANT MINES AT A GIVEN HEX
         MOVE              DIRECT UNIT TO MOVE TO A SPECIFIED HEX
         RESUPPLY          TRANSFER SUPPLIES BETWEEN FRIENDLY UNITS
         SEALIFT           MOVE UNIT ON NAVY SHIP
         SEND              SEND MESSAGE TO OPPOSING FORCE
         SITREP            REQUEST A SITUATION REPORT
         THRESHOLD         SET/DETERMINE A UNITS WITHDRAWAL LEVEL
```

```
        TIME            REQUEST  CURRENT BATTLE TIME
        HELP            PRINTS THIS HELP MESSAGE
        DONE            EXIT HELP ROUTINE

        ENTER CTRL/Y    TO RESTART THIS SESSION
              VERBOSE   DETAILED DESCRIPTION OF COMMAND
              BRIEF     BRIEF DESCRIPTION OF COMMAND (DEFAULT)
$ !
$ GOTO 'PROMPT'
$ !
$ AIRØ:
$       TYPE SYS$INPUT

        ************************************************************
        *                                                          *
        *      AIR     ON COORDINATES          |FROM #UNIT ID      *
        *                                      |FROM COORDINATES   *
        *                                                          *
        *      |ROAD                                               *
        *      |BRIDGE                              |TIME          *
        *      |NUCLEAR       NUMBER SORTIES START  |NOW           *
        *      |CHEMICAL                                           *
        *      |MINE                                               *
        *                                                          *
        ************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes an air attack on the specified hex consisting of the ordered number of aircraft sorties (not unit sorties) from the specified friendly unit. Unit ID must be of type AIRFORCE, HELICOPTER, or AC CARRIER; must be a friendly unit; must have sufficient pol and ammunition; and must not be engaged in combat. When coordinates follow the word FROM, all air units at that location participate in the attack. If no start time is specified, NOW is assumed. If the number of sorties specified is greater than the number of available aircraft in the unit, all available aircraft are sent out,return, are rearmed and refueled (time delay), and reattack the target. This process repeats until the number of sorties requested is satisfied. If the number of sorties is not specified, all aircraft available in the specified unit are sent out one one sortie. During the first 3 days of combat, 80 percent of the aircraft in a unit is available for action at any given time; after that, availability drops to 60 percent. If the words ROAD or BRIDGE appear in the order, the aircraft mission is to destroy roads, bridges, tunnels,etc., rather than combat units. If the words NUCLEAR or CHEMICAL appear in the order, this is to be a nuclear or chemical airstrike. The model checks to see if the requesting force has been granted nuclear or chemical permission by the game controller. If it has not been, then the order is ignored, and the requestor is so informed. If the word MINE appears in the order, the mission is to air emplace a minefield. Every air mission has a certain probability of detecting and reporting enemy units flown over. That probability is less at night or in adverse weather. Every enemy ground unit flown over has ground air defense weapons that have a chance of shooting down aircraft. The percent of aircraft shot down is less at night or in adverse weather. Ingress and egress flight paths are different. Aircraft making it to the target do a fixed percent damage to the target and slow up that target by 15 minutes if it were moving, firing artillery, or sending out air sorties.

EXAMPLES:

AIR ON F86 FROM #211 10 SORTIES

10 SORTIES AIR ON F86 FROM #211 START NOW

SURPRISE THEM. START 11:50 HOURS 10 SORTIES FROM #211 ON F86 AIR

AIR ON F86 ROADS FROM #211

```
        AIR FROM HH70 ON F86 NUCLEAR

        AIR FROM #211 FON F86 MINE


$ GOTO NEXT
$ AIRLIFT0:
$       TYPE SYS$INPUT

        ******************************************************************
        *                                                                *
        *       AIRLIFT # UNIT ID        ON # UNIT ID2   TO COORDINATES  *
        *                                  |STAY           START  |Time  *
        *                                                         |Now   *
        *                                                                *
        ******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

The unit chosen to do the airlifting must be of type AIR FORCE OR helicopter. The unit to be airlifted must be at the same location and on the same side (Red or Blue) as the lifting unit. Navy units cannot be airlifted. The lifting unit must have sufficient POL to reach its destination and return. If all of the above criteria are met, the airlift order is approved and the lifted unit arrives at its specified destination 2 hours plus flight time after the airlift began. If, at the time of landing, the landing zone is occupied by one or more enemy units, the aircraft return to base without dropping off the lifted unit. Whatever damage is done to the lifting unit by air defenses and air-to-air engagements is also done to the unit being lifted until it is dropped off. If the word STAY appears in the order, the airlifting unit stays at the landing zone with the airlifted unit. If not, the airlifting unit returns to its original base.

EXAMPLES:

```
        AIRLIFT #101 ON #703 TO HH86

        TO HH86 ON #703 #101 AIRLIFT

        #101 TO HH86 ON #703 AIRLIFT START 11.50 HOURS

        ORDER & SPACING DO NOT MATTER AIRLIFT ON #703 TO HH86 #101

        AIRLIFT ON $703 #701 TO HH86 STAY
```

```
$GOTO NEXT
$ CANCEL0:
$       TYPE SYS$INPUT

        ****************************************************************
        *                                                              *
        *       CANCEL             # UNIT             |ALL             *
        *                                                              *
        ****************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

The CANCEL order tells the specified unit number to stop what it is doing and to wait for a new order. If the word ALL is added to the CANCEL order, the specified unit not only stops what it is currently doing, it also scrubs all planned missions.

EXAMPLES:

```
        CANCEL #701

        #701 CANCEL ALL

        ALL CANCEL #701

        #701 CANCEL
```

```
$ GOTO NEXT
$ DCA0:
$       TYPE SYS$INPUT

        *****************************************************************
        *                                                               *
        *       DCA     # UNIT ID                                       *
        *                                                               *
        *****************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

The specified unit number is assigned to Defensive Counter Alert. All enemy aircraft passing into range of the specified air unit and detected by a radar unit will be engaged by the DCA aircraft, unless they have already been scrambled.

EXAMPLES:

```
        DCA #712

        #712 DCA
        ASSIGN #712 TO DCA

$ GOTO NEXT
$ DESTROYØ:
$       TYPE SYS$INPUT

        ******************************************************************
        *                                                                *
        *       DESTROY             COORDINATES                          *
        *                                                                *
        ******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes friendly units at the specified coordinates to destroy all roads, bridges, tunnels, etc., to reduce trafficability through the specified area. If no friendly units are present at the specified area, the requesting commander will be so informed and the order ignored. If it is desired to have a unit burn the bridges behind it, tell that unit to move first, then tell it to destroy the bridge. Otherwise, the unit will execute the orders in the sequence in which they are received--blow bridge then cross river. This could make the simulated men in that unit quite angry (and wet).

EXAMPLES:

```
        DESTROY H7Ø

        DESTROY BRIDGE H7Ø

        H7Ø ROAD DESTROY
```

```
$ GOTO NEXT
$ ESCORTØ:
$       TYPE SYS$INPUT

        *********************************************************
        *                                                       *
        *       ESCORT          # UNIT ID       WITH # UNIT ID  *
        *                                                       *
        *********************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes the specified air unit preceded by the word "WITH" to escort the other air unit until told otherwise. The presence of escort aircraft with an Air Force unit helps protect the mission aircraft (bomber and attack) from enemy air interceptors and ground air defenses. Unescorted air units will jettison their ordnance and return to base if attacked by enemy fighters.

EXAMPLES:

```
        ESCORT #7Ø3 WITH #9Ø5

        WITH #9Ø5 ESCORT #7Ø3

        WITH #9Ø5 #7Ø3 ESCORT


$ GOTO NEXT
$ FIREØ:
$       TYPE SYS$INPUT
```

```
*****************************************************************
*                                                               *
*       FIRE    ON COORDINATES          |FROM # Unit ID         *
*                                       |FROM Coordinates       *
*                                                               *
*       Number VOLLEYS    |NUCLEAR      START      |NOW         *
*                         |CHEMICAL                |Time        *
*                                                               *
*****************************************************************
```

```
$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This command causes artillery, missile, or naval gunfire on the designated hex coordinates. The number of volleys refers to the number of unit volleys (not tube volleys) to be fired on the target. If the number of volleys is not specified, one volley is assumed. If the start time is not specified, START NOW is assumed. When coordinates follow the word FROM, all indirect fire units at that location participate in the fire mission. Every new fire request takes 15 minutes for communication delays and to plan the fire mission. The time between volleys on the same target is 3 minutes for tube artillery-type units, and 6 hours for rockets and missiles. If a new fire order for this unit is received before the old order is completed, the unit will start firing on the new target after the last order is completed. In order for a fire order to be executed, the unit specified must be friendly, indirect-firing type, non-moving, not engaged in ground combat, within range of its weapons to the target, and have sufficient ammunition on hand. Each volley impinging on the target damages all units in the specified hex and slows them up by 15 minutes. If the words NUCLEAR or CHEMICAL appear in the order, this is to be a nuclear or chemical mission. The model then checks whether or not the requesting force (Blue or Red) has been granted nuclear or chemical permission by the game controller. If permission has not been granted, the order is ignored and the requestor is informed.

```
EXAMPIES:

        FIRE ON Z50 FROM #115

        ON Z50 FIRE 1 VOLLEY FROM #115 START 9.50 HOURS

        FIRE 7 VOLLEYS FROM #116 ON Z50 HOLD IT DOWN I'M TRYING TO SLEEP

        FIRE FROM AA45 ON Z50 CHEMICAL

        START 17.81 HOURS TO FIRE ON Z50 FROM AA45

$ GOTO NEXT
$ INTFLØ:
$       TYPE SYS$INPUT

        ******************************************************************
        *                                                                *
        *               INTEL         Coordinates                        *
        *                                                                *
        ******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes one or more human agents to be sent to the specified coordinates to report on all enemy activity in that hex. When a war gamer receives information from HUMINT, it is 1 hour old, and locations, activities and strengths may have changed.

EXAMPIES:

```
          INTEL AA71

          AA71 INTEL

          YE OLDE CLOAK AND DAGGER INTEL ON AA71

$ GOTO NEXT
$ LOGREPØ:
$         TYPE SYS$INPUT

          ****************************************************
          *                                                  *
          *                     LOGREP                       *
          *                                                  *
          ****************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$         TYPE SYS$INPUT
```

DESCRIPTION:

This order causes a complete logistics report to be generated on all friendly units. The unit number, number of people in that unit, number of tons of 12 classes of supplies (1 through 1Ø plus 3A and 5A), and the maximum carrying capacity of the unit are printed out for each friendly unit on the map.

EXAMPLES:

```
          LOGREP

          PLEASE GIVE ME A LOGREP
```

```
$ GOTO NEXT
$ MINEØ:
$       TYPE SYS$INPUT

        ************************************************************
        *                                                          *
        *               MINE                 Coordinates           *
        *                                                          *
        ************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes a ground or Navy unit at the specified coordinates to emplace a minefield. There must be a friendly unit that is not engaged in combat, with at least one ton of class 5 supplies, in the specified hex or the program will state the reason the order cannot be executed. Artillery-emplaced minefields can be emplaced by contacting the controllers. Air and helicopter-emplaced minefields are ordered with the AIR command. Any unit (including a friendly unit) which enters a mined hex will suffer a 3% loss and a 2 to 4-hour delay while clearing the minefield. Any unit unfortunate enough to enter a minefield that is overwatched by enemy forces will have its combat strength halved.

EXAMPLES:

```
MINE HH4Ø

HH4Ø MINE

MINE HH4Ø WHERE'S MY SHOVEL?

NAVY UNITS CAN MINE 236 TOO!
```

```
$ GOTO NEXT
$ MOVEØ:
$       TYPE SYS$INPUT

        **************************************************************
        *                                                            *
        *                                                            *
        *   MOVE   |Unit ID              TO Coordinates  AT   Speed  *
        *          |FROM Coordinates                                 *
        *                                                     |Time  *
        *                                           START     |NOW   *
        *                                                            *
        *                                                            *
        **************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes a unit to begin moving to the specified location if it is not out of POL. If no speed is specified, the unit will move at its maximum speed. If no start time is specified, the unit will start now. The unit will choose the fastest route (easiest terrain) from where it is to its destination. If another route is desired, the move must be broken up into a series of move statements. The second move can be entered before the first is completed. Movement is stopped whenever an enemy unit is contacted, and a warning message is given to both Red and Blue commanders. Movement after contact can be started again by issuing a new MOVE order. Movement is slowed by enemy air attacks; incoming artillery; minefields; nuclear, chemical, or biological contamination; terrain features; and adverse weather. Movement consumes POL. When coordinates follow the word FROM, all units at that location begin moving to the specified destination.

EXAMPLES:

```
     MOVE #101 TO FF16

     START NOW TO FF16 AT 20 MPH MOVE #101

     WALK SOFTLY AND CARRY A BIG STICK MOVE #101 TO FF16

     MOVE ALL UNITS FROM HH78 TO II81 START 11.90 HOURS

     MOVE FROM HH78 TO II81

$ GOTO NEXT
$ RESUPPLY0:
$       TYPE SYS$INPUT

     *******************************************************************
     *                                                                 *
     * RESUPPLY  #Unit ID   FROM #Unit ID  Number TONS  Class Number   *
     *                                                                 *
     *******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

Generally, the unit from which the supplies are coming is a transportation unit. However, supplies can be transferred between any two friendly units. If there is enough of the specified class of supplies in the giving unit, the number of tons specified will be given to the receiving unit. If no class of supply is specified, all classes will be transferred. If no tonnage is specified, 90% of the specified class of supplies in the giving unit will be transferred to the receiving unit. A warning message will be printed for each unit that gets dangerously low (less than 12 hours at current consumption rate) in any class of supply. If a unit runs out of POL in combat, its combat strength is halved. If a unit runs out of AMMO in combat, it is destroyed. So, close attention must be given to logistics problems. Since units must be colocated in order to transfer supplies, attention must be given to resupplying a unit before that unit runs completely out of any class of supplies. Supply shipments may be delayed, damages, or destroyed enroute due to enemy actions.

EXAMPLES:

```
        RESUPPLY #1Ø2 3Ø TONS OTHER FROM #51Ø

        45 TONS POL TO RESUPPLY #1Ø3 FROM #511

        FROM #512 9Ø TONS RESUPPLY #1Ø4

        HOT FOOD AT LAST RESUPPLY #117 2 TONS OTHER FROM #513

        RESUPPLY #1Ø4 FROM #512


$ GOTO NEXT
$ SEALIFTØ:
$       TYPE SYS$INPUT

        ***********************************************************************
        *                                                                     *
        * SEALIFT  #Unit ID   ON #Unit ID  TO Coordinates   START   |Time *
        *                                                           |NOW*
        *                                                                     *
        ***********************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

The unit chosen to do the sealifting must be of type NAVY and be adjacent to the unit to be sealifted. Both units must be on the same side (Red or Blue). Whatever damage is done to the NAVY unit enroute to its destination is also inflicted upon the unit being carried. The time of arrival at the specified destination is a function of the speed of the NAVY ships and the distances involved. If the specified destination is occupied by one or more enemy units by the time the sealift arrives, the commander will be so informed, and the lifted unit will stay on board and wait for a new SEALIFT order. NOTE: The destination specified in the order must be a land destination, NOT a water destination.

EXAMPLES:

```
        SEALIFT #1Ø2 ON #5Ø4 TO 23Ø

        #1Ø2 SEALIFT ON #5Ø4 TO 23Ø.  THE MARINES HAVE LANDED.

        START 23.7Ø HOURS TO 23Ø #1Ø2 BY SEALIFT TO 23Ø


$ GOTO NEXT
$ SENDØ:
$       TYPE SYS$INPUT

        ******************************************************************
        *                                                                *
        *                      SEND       Message                        *
        *                                                                *
        ******************************************************************

$ IF BRIEF .EQS. 'YES' THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

This order causes the message line to be sent to the opposing force's computer terminal, with a heading of FROM BLUE COMMANDER or FROM RED COMMANDER.

EXAMPLES:

```
        SEND:  YOU ARE SURROUNDED--DO YOU WISH TO SURRENDER?

        SEND:  NUTS!
```

```
$ GOTO NEXT
$ SITREPØ:
$       TYPE SYS$INPUT

        ***************************************************************
        *                                                             *
        *                     SITREP      |#UNIT ID                   *
        *                                                             *
        ***************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

If no unit is specified, this order causes a printout of accurate data on all friendly units. Data such as the unit ID, name, location, percent strength, activity, destination, weather, and battle time are listed. If a unit number is specified, more detailed information on just that unit will be printed out. Of course, the model will not let the player check on enemy units with this order.

EXAMPLES:

```
        SITREP

        SIT REPORT

        SITUATION

        SITUATION REPORT

        SITREP #12

$ GOTO NEXT
$ THRESHOLDØ:
$       TYPE SYS$INPUT

        ************************************************************
        *                                                          *
        *       THRESHOLD       |#Unit ID          Percent          *
        *                       |ALL                               *
        *                                                          *
        ************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT
```

DESCRIPTION:

The THRESHOLD concept allows commanders to determine whether a unit is to hold at all costs, avoid decisive engagement, or something in between these extremes. The percent specified in this order is the percent strength at which the specified unit will break contact with the enemy. If the word ALL is used in place of a specific unit number, all friendly units will break contact at that percent strength.

EXAMPLES:

```
        THRESHCLD #1Ø1 75%

        THRESHOLD ALL 5Ø%

        #1Ø2 THRESHOLD Ø%

$ GOTO NEXT
$ TIMEØ:
$       TYPE SYS$INPUT

        ******************************************************************
        *                                                                *
        *                             TIME                               *
        *                                                                *
        ******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT

DESCRIPTION:

        This order causes the program to print the current battle time.

EXAMPLES:

        TIME

        WHAT TIME IS IT?
$ GOTO NEXT
$ !
$ COMMØ:
$       TYPE SYS$INPUT
```

```
                 ******************************************************************
                 *                                                                *
                 *                            COMM                                *
                 *                                                                *
                 ******************************************************************

$ IF BRIEF .EQS. "YES" THEN GOTO NEXT
$       TYPE SYS$INPUT

DESCRIPTION:

        This order causes the program to activate the communications assets
        in your command.  Allowing you to read incoming messages and/or send
        messages over available communications circuits.


        NOTE:   The following options are also available to exercise at your
                convenience.

                        READ MESSAGE            Reads entire message file
                        SEND MESSAGE            Send a message on comm net
                        READ MAIL               Read messages selectively

EXAMPLES:

        COMM

        READ MESSAGE

        SEND MESSAGE

        READ MAIL

$ GOTO NEXT
$ !
$ !
$ DONEØ:
$ !
$ TYPE SYS$INPUT


$ EXIT



*** CKMSG.COM ***

$   START_CKMSG:
$ !
$  NOCIRCUITØ := "YOU HAVE NO CIRCUITS TO "
$  NOCIRCUIT1 := "YOU HAVE NO ENCRYPTED LANDLINE TO "
$  NOCIRCUIT2 := "YOU HAVE NO NON-ENCRYPTED LANDLINES (AUTODIN) TO "
$  NOCIRCUIT3 := "YOU HAVE NO DIGITAL RF CIRCUITS (HF/VHF/UHF) WITH A/J TO "
$  NOCIRCUIT4 := "YOU HAVE NO DIGITAL RF CIRCUITS (HF/VHF/UHF) W/O A/J TO "
$  NOCIRCUIT5 := "YOU HAVE NO VOICE CIRCUIT TO "
$  NOCIRCUIT6 := "YOU DO NOT HAVE A PERFECT LINK TO "
$ !
$        IF RM_PLAYER_CNT .EQ. Ø THEN GOTO NONE_REMOVED
$        RMCNT = 1
$   CK_REMOVED:
$ !
$        IF "''FROM'" .EQS. RM_PLAYER_NAME'RMCNT' THEN GOTO NOT_A_PLAYER
$        RMCNT = RMCNT + 1
$        IF RMCNT .LE. RM_PLAYER_CNT THEN GOTO CK_REMOVED
$ !
$   NONE_REMOVED:
$ !
$ !  THIS STEP DETERMINES THE IDENTITY OF THE PLAYER SENDING THE MESSAGE
$ !  IT MUST MATCH THE GAME USER/PLAYER TABLE
$ !
$       CNT = 1
$       INDEX = 0
$   FROM_LOOP:
$ !
$       IF FROM .EQS. PLAYER'CNT' THEN INDEX = 'CNT'
$       IF INDEX .NE. 0  THEN GOTO OVER_FROM
$       CNT = CNT + 1
$       IF CNT .GT. 'PLAYCNT' THEN GOTO NOT_A_PLAYER
$       GOTO FROM_LOOP
$ !
$   NOT_A_PLAYER:
$       WRITE SYS$OUTPUT " ATTENTION:   ''FROM' "
$       TYPE SYS$INPUT

        DID YOU SPELL YOUR NAME CORRECTLY.  IF NOT, RESUBMIT
        YOUR MESSAGE.

        IF, HOWEVER, IT IS SPELLED CORRECTLY , THE FOLLOWING
        NOTE APPLIES:

        YOU ARE NO LONGER AN ACTIVE PLAYER IN THIS GAME!!!!!
        WAIT FOR FURTHER INSTRUCTIONS FROM THE CONTROLLER.

$ !
$  SEVERITY == 2
$ EXIT
$ !
$   OVER_FROM:
$ !
$  IF REAL_FROM .NES. DIRECTORY_NAME'CNT' THEN GOTO INVALID_FROM
$ !
$  INDEX1 = 'CIRCUIT_TYPE' - 1 !DEFINE AN INDEX FOR THE EXTRACT LEXICAL
$                              !FUNCTION TO DETERMINE LINK AVAILABILITY.
$  IF CIRCUIT_TYPE .EQ. 0 THEN INDEX1 = 0 ! USE AVAILABLE CIRCUIT
$ !
$  OPEN/WRITE OUTFILE MAILING.DAT
$  OPEN/WRITE OUTFILE1 MAILING.TMP
$ !
$          WRITE OUTFILE1 CIRCUIT_TYPE  ! STORE CIRCUIT TYPE FOR MSG HANDLER
$ !
$  LOCATE_LOOP1:
$          CNT = 1
$          NUMCNT = 0
$          IF CNT .GT. 'PLAYCNT' THEN GOTO DONE
$ !
$ ! ******************************************************************
$          INDEX2 = 'INDEX1'
$ !
$ IF 'F$LOCATE(PLAYER1,TO)' .EQ. 'F$LENGTH(TO)' THEN GOTO LOCATE_LOOP
$          IF PLAYER1 .EQS. FROM THEN GOTO LOCATE_LOOP
$    TEST_NEXT:
$          TEST_LINK := ''F$EXTRACT(''INDEX2',1,LINK''INDEX'TO1)'
$          IF 'TEST_LINK' .EQ. 0 .AND. CIRCUIT_TYPE .NE. 0 THEN GOTO NO_LINK
$          IF 'TEST_LINK' .EQ. 1 THEN GOTO GOT_LINK
$          INDEX2 = INDEX2 + 1
$          IF INDEX2 .GT. 5 THEN GOTO NO_LINK
$          IF INDEX2 .LE. 5 THEN GOTO TEST_NEXT
$          GOTO LOCATE_LOOP
$    GOT_LINK:
$          WRITE OUTFILE LINK'INDEX'TO1
$          WRITE OUTFILE DIRECTORY_NAME1  ! MSG ADDRESSED TO THIS PLAYER
$          WRITE SYS$OUTPUT " ''PLAYER1'  ---  OK"
$          NUMCNT = NUMCNT + 1
$ !
$ !
$  LOCATE_LOOP:
$          INDEX2 = 'INDEX1'
$          CNT = CNT + 1
$          IF CNT .GT. 'PLAYCNT' THEN GOTO DONE
$ !
$         TEST_LOCATE := "'F$LOCATE(PLAYER''CNT',TO)'"
$         IF 'TEST_LOCATE' .EQ. 'F$LENGTH(TO)' THEN GOTO LOCATE_LOOP
$         IF PLAYER'CNT' .EQS. FROM THEN GOTC LOCATE_LOOP
$    TEST_NEXT1:
$         TEST_LINK := "'F$EXTRACT(INDEX2,1,LINK''INDEX'TO''CNT')'"
$         IF 'TEST_LINK' .EQ. Ø .AND. CIRCUIT_TYPE .NE. Ø THEN GOTO NO_LINK
$         IF 'TEST_LINK' .EQ. 1 THEN GOTO GOT_LINK1
$         INDEX2 = INDEX2 + 1
$         IF INDEX2 .GT. 5 THEN GOTO NO_LINK
$         IF INDEX2 .LE. 5 THEN GOTO TEST_NEXT1
$         GOTO LOCATE_LOOP
$    GOT_LINK1:
$         WRITE OUTFILE LINK'INDEX'TO'CNT'
$         WRITE OUTFILE DIRECTORY_NAME'CNT'  ! MSG ADDRESSED TO THIS PLAYER
$         PRT_NAME := "'PLAYER''CNT'"
$         PRT_NAM  := 'PRT_NAME'
$         WRITE SYS$OUTPUT  " ''PRT_NAM' ---  OK"
$         NUMCNT = NUMCNT + 1
$ !
$         GOTO LOCATE_LOOP
$ !
$ !
$   DONE:
$   IF NUMCNT .LE. Ø .OR. NUMCNT .EQS. "" THEN GOTO NO_ADDRESSEE
$ !
$   WRITE OUTFILE1 NUMCNT
$         CLOSE OUTFILE
$         CLOSE OUTFILE1
$         APPEND MAILING.DAT MAILING.TMP
$ !
$ !       SUBMIT MAILER.COM
$ !
$ ! THE MESSAGE HANDLER ROUTINE IS A FORTRAN PROGRAM WHICH
$ ! COMPUTES THE DELAY TIME AND CALLS A MESSAGE GARBLER
$ ! ROUTINE
$ !
$ RUN DRA0:[CLARK.CCC]MSGHAN
$ !
$  SEVERITY == 0
$  EXIT
$ !
$  NO_LINK:
$ !
$  WRITE SYS$OUTPUT NOCIRCUIT'CIRCUIT_TYPE'
$  WRITE SYS$OUTPUT PLAYER'CNT'
$  GOTO LOCATE_LOOP
$ !
$   NO_ADDRESSEE:
$ !
$        CLOSE OUTFILE
$        CLOSE OUTFILE1
$   WRITE SYS$OUTPUT "  INVALID ADDRESSEE :  ''TO'"
$ !
$  SEVERITY == 3
$  EXIT
$ !
$   INVALID_FROM:
$ !
$  TYPE SYS$INPUT

                         *****************

     WHEN SENDING A MESSAGE YOU MUST USE YOUR CORRECT IDENTITY.

     PLEASE USE YOUR CORRECT PLAYER NAME WHEN "FROM" IS REQUESTED.

                         *****************

$  INQUIRE/GLOBAL FROM "  RE-ENTER <FROM> ( ENTER <CR> ONLY TO ABORT )"
$ !
$  IF FROM .NES. "" THEN GOTO START_CKMSG
$  SEVERITY == 3
$  TYPE SYS$INPUT

       **** MESSAGE ABORTED ****

$  EXIT
$ !


*** SENDMSG.COM ***

$ SET MESSAGE /NOTEXT/NOFACILITY/NOIDENTIFICATION/NOSEVERITY
$ DELETE SENDMSG.LOG.*
$ !
$ ASSIGN DUMMY SYS$PRINT  ! PREVENTS JOB LOG PRINTOUT
$ !
$ ! ******I KNOW WHO THE MESSAGE IS FROM *********
$ ! ******DETERMINE WHO THE MESSAGE IS GOING TO ******
$ ! ******WHAT CIRCUIT IS AVAILABIE TO HIM ******
$ ! ******WHAT IS THE LOSS RATE FOR THAT CIRCUIT*****
$ ! ******WHAT IS THE GARBLE RATE FOR THAT CIRCUIT ****
$ ! ******WHAT ARE THE ARRIVAL AND SERVICE RATES FOR THE CIRCUIT*****
$ !
$ SUB_HEADØ := "EXPEDITE -- FIRST AVAILABLE CIRCUIT"
$ SUB_HEAD1 := "ENCRYPTED LANDLINE WITH PRECEDENCE CONTROL"
$ SUB_HEAD2 := "NON-ENCRYPTED LANDLINE (AUTODIN)"
$ SUB_HEAD3 := "DIGITAL RF CIRCUITS (HF/VHF/UHF) WITH A/J"
$ SUB_HEAD4 := "DIGITAL RF CIRCUITS WITHOUT A/J"
$ SUB_HEAD5 := "VOICE"
$ SUB_HEAD6 := "PERFECT LINK"
$ !
$ DELETE HEADER.TXT.'PC'
$ !
$ OPEN/WRITE OUTFILE HEADER.TXT.'P6'  ! CREATE HEADER FOR MESSAGE
$ !
$ WRITE OUTFILE SUB_HEAD'P8'
$ WRITE OUTFILE " "
$ WRITE OUTFILE "''F$TIME()'"
$ WRITE OUTFILE " "
$ WRITE OUTFILE " "
$ WRITE OUTFILE "FM  ''P4' "
$ WRITE OUTFILE "TO  ''P7' "
$ WRITE OUTFILE " "
$ WRITE OUTFILE " "
$ WRITE OUTFILE "BT  "
$ !
$ CLOSE OUTFILE
$ !
$ FILNAM := 'P2'
$ ISTAT := 'F$EXTRACT(5,1,FILNAM)'
$ !
$ COPY/REPLACE  HEADER.TXT.'P6',MESSAGE.TXT,STAT'ISTAT'.TXT SENDMSG.TXT.'P6'
$ !
$ ! SEND COPY OF ORIGINAL MESSAGE TO MTM MAIN GAME DIRECTORY
$ ! FOR LATER ANALYSIS
$ !
$ MAIL /SUBJECT:"''P1'" SENDMSG.TXT.'P6' CLARK  ! GAME DIRECTORY
$ !
$ !
$  IF "''P3'" .EQS. "CONTROLLER" .OR. "''P3'" .EQS. " CONTROLLER" THEN -
   GOTO DONE
$ !
$ ! GARBLE FILE MESSAGE.TXT USING ABOVE PARAMETERS
$ !
$ ! SEND COPY OF GARBLED MESSAGE TO MTM MAIN GAME DIRECTORY
$ ! FOR LATER ANALYSIS
$ !
$ !
$ !
$ COPY/REPLACE  HEADER.TXT.'P6','P2' SENDMSG.TXT.'P6'
$ !
$ !
$ MAIL /SUBJECT:"''P1'" SENDMSG.TXT.'P6' CLARK  ! SEND GARBLED MSG TO GAME DIREC
$ !
$ !
$ ! THE WAIT TIME WILL BE A PARAMETER
$ WAIT 'P5'
$ MAIL /SUBJECT:"''P1'" SENDMSG.TXT.'P6' 'P3'
$ !
$  DONE:
$ !
$ SET MESSAGE /TEXT/FACILITY/IDENTIFICATION/SEVERITY
$ !
$ EXIT
```

```
*** INOUTP.FOR ***


        INCLUDE 'COM1.FOR/LIST'
        INCLUDE 'COM3.FOR/LIST'
        INCLUDE 'COM4.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM3.FOR/LIST'
        INCLUDE 'CMTM4.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM5.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM62.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM63.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM64.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM65.FOR/LIST'
        INCLUDE 'RDMAIL.FOR/LIST'
        INCLUDE 'MYCALL.FOR/LIST'
        INCLUDE 'DRA0:[CLARK.MTM]MTM19.FOR/LIST'
```

```
*** INOUTP1 ***

      INCLUDE 'XCOM1.FOR/LIST'
      INCLUDE 'COM3.FOR/LIST'
      INCLUDE 'COM4.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM3.FOR/LIST'
      INCLUDE 'CMTM4.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM5.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM62.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM63.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM64.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM65.FOR/LIST'
      INCLUDE 'RDMAIL.FOR/LIST'
      INCLUDE 'MYCALL.FOR/LIST'
      INCLUDE 'DRA0:[CLARK.MTM]MTM19.FOR/LIST'


*** MSGHAN.FOR ***

      INTEGER LNKTYP, NUMADD
      INTEGER*4 HRS,MINUTS,SECS,LIB$DO_COMMAND
      INTEGER*4 SEED, IPLOSS, IGRBRAT, IPGARB
      INTEGER*4 LTR,LTRNUM,SEED7
      CHARACTER ADDNAM*10, LNKCOD*6, ICODE*1,FROM*10,DATA1*80,DATA2*80
      CHARACTER NEWLTR*1,LETTER*1
      REAL*4 FACTOR, PLOSS, URAN, ARR, SERV, DELAY, A, S, GRBRAT,PGARB
      REAL*4 GARBLE,RANNUM,GARVAL
      DIMENSION ICODE(6), PLOSS(6), IPLOSS(6), A(6), S(6),
     1GRBRAT(6), IGRBRAT(6), IPGARB(6)
      DIMENSION NEWLTR(80),GARBLE(6),LETTER(80)
      EQUIVALENCE (DATA2,NEWLTR(1))
      EQUIVALENCE (LNKCOD,ICODE(1))
```

```
C
      GRBRAT(6) = Ø.Ø
      FLOSS(6)  = Ø.Ø
      S(6) = 9999.9
      A(6) = .1
C
C     DETERMINE THE GAME PLAYING SPEED (FACTOR) AND ADJUST DELAY TIMES
C     ACCORDINGLY.  DEFAULT SETTING IS Ø.1
C
      OPEN(UNIT=1,FILE='DRAØ:[CLARK]FACTOR.DAT',STATUS='OLD',ERR=1Ø)
      READ(1,*)FACTOR
      GO TO 2Ø
C
   1Ø FACTOR=Ø.1
C
   2Ø CLOSE(UNIT=1)
C
C     OPENING MAILING FILE WITH LINK PARAMETERS
C
      OPEN(UNIT=1,FILE='MAILING.TMP',STATUS='OLD')
      READ(1,*) I_CKT
      READ(1,*) NUMADD
C
C     GET THE UNIFORM RANDOM SEED FOR THE CIRCUIT TYPE REQUESTED
C
      IF (I_CKT .EQ. Ø ) THEN
         OPEN(UNIT=1Ø,FILE='SEEDØ.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 1 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED1.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 2 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED2.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 3 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED3.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 4 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED4.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 5 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED5.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 6 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED6.DAT',STATUS='UNKNOWN')
      ENDIF
C
         READ(1Ø,*,ERR=11,END=11)SEED
         CLOSE(UNIT=1Ø)
C
      GO TO 21
C
   11 CONTINUE
C
      SEED = 16762
         CLOSE(UNIT=1Ø)
C
   21 CONTINUE
C
      OPEN(UNIT=2,FILE='DRAØ:[CLARK]PARAMETER.DAT',STATUS='OLD',
     1READONLY)
C
      READ(2,1ØØ1) A(1),A(2),A(3),A(4),A(5)
      READ(2,1ØØ1) S(1),S(2),S(3),S(4),S(5)
      READ(2,1ØØ2) IPLOSS(1),IPLOSS(2),IPLOSS(3),IPLOSS(4),IPLOSS(5)
      READ(2,1ØØ2) IGRBRAT(1),IGRBRAT(2),IGRBRAT(3),
     1 IGRBRAT(4),IGRBRAT(5)
      READ(2,1ØØ2) IPGARB(1),IPGARB(2),IPGARB(3),IPGARB(4),IPGARB(5)
 1ØØ1 FORMAT(F/F/F/F/F)
 1ØØ2 FORMAT(I/I/I/I/I)
C
      REWIND 2
      CLOSE (UNIT=2)
C
      DO 89 I=1,5
          PLOSS(I) = FLOAT(IPLOSS(I))/1ØØ.Ø
```

```
        GRBRAT(I) = FLOAT(IGRBRAT(I))/1ØØ.Ø
   69 CONTINUE
C
C  READ IN THE LIST OF SUBSTITUTABLE CHARACTERS WHICH EXCLUDES CARRIAGE RETURN
C  AND LINEFEED, THOSE CHARACTERS ARE HANDLED SEPERATELY.
      OPEN(UNIT=15,FILE='DRAØ:[CLARK.CCC]LETTER.TXT',STATUS='OLD')
C  THE NUMBER OF CHARACTERS CONTAINED IN LETTER() DETERMINES THE LOOP LIMIT
      DO 55 LTR=1,57
        READ(15,11ØØ,END=998,ERR=9998)LETTER(LTR)
   55 CONTINUE
  998 CLOSE(UNIT=15)
C
C  OBTAIN LAST VALUE OF THE SEED USED IN THE GENERATION OF RANDOM NUMBERS,
C  VALUE IS STORED SO THAT SEQUENCE IS NOT REPEATED EVERY TIME A LINE IS
C  GARBLED
      SEED7 = 16888
      OPEN(UNIT=16,FILE='SEED.DAT',STATUS='OLD',ERR=1112)
      READ(16,*)SEED7
      CLOSE(UNIT=16)
 1112 CONTINUE
C
C  OPEN A MESSAGE ADDRESS FILE THAT IS TO CONTAIN THE
C  GARBLE TEXT FILE NAME, THE DELAY TIME AND TO WHOM
C  THE MSG IS ADDRESSED -- MESSAGE OUTFILE.
C
      OPEN(UNIT=12,FILE='MSGOUT.TXT',STATUS='NEW')
      OPEN(UNIT=3,FILE='MESSAGE.TXT',STATUS='OLD',READONLY)    ! ORIG. MESSAGE TE
C
C  DETERMINE FOR EACH ADDRESSEE WHICH LINK TO BE USED
C
      INX = Ø
      DO 5ØØ I=1,NUMADD
      INX = INX + 1
   9Ø READ(1,1ØØ3) LNKCOD, ADDNAM
 1ØØ3 FORMAT(A6/A)
```

```
      IF (I_CKT .EQ. Ø) THEN
            GO TO 21Ø1
        ELSE
            LNKTYP = I_CKT
      ENDIF
 21Ø2 CONTINUE
C
C    OPEN A FILE TO SAVE EACH MESSAGE PARAMETERS FOR LATER ANALYSIS
C
        INSTAT = I
        IF ( INSTAT .EQ. 1 ) THEN
                OPEN(UNIT=17,FILE='STAT1.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
                OPEN(UNIT=4,FILE='GARBL1.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
           ELSE IF ( INSTAT .EQ. 2 ) THEN
                OPEN(UNIT=17,FILE='STAT2.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
                OPEN(UNIT=4,FILE='GARBL2.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
           ELSE IF ( INSTAT .EQ. 3 ) THEN
                OPEN(UNIT=17,FILE='STAT3.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
                OPEN(UNIT=4,FILE='GARBL3.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
           ELSE IF ( INSTAT .EQ. 4 ) THEN
                OPEN(UNIT=17,FILE='STAT4.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
                OPEN(UNIT=4,FILE='GARBL4.TXT' STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
           ELSE IF ( INSTAT .EQ. 5 ) THEN
                OPEN(UNIT=17,FILE='STAT5.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
                OPEN(UNIT=4,FILE='GARBL5.TXT',STATUS='NEW',
        1         CARRIAGECONTROL='LIST')
```

```
          ELSE IF ( INSTAT .EQ. 6 ) THEN
                 OPEN(UNIT=17,FILE='STAT6.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
                 OPEN(UNIT=4,FILE='GARBL6.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
          ELSE IF ( INSTAT .EQ. 7 ) THEN
                 OPEN(UNIT=17,FILE='STAT7.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
                 OPEN(UNIT=4,FILE='GARBL7.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
          ELSE IF ( INSTAT .EQ. 8 ) THEN
                 OPEN(UNIT=17,FILE='STAT8.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
                 OPEN(UNIT=4,FILE='GARBL8.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
          ELSE IF ( INSTAT .EQ. 9 ) THEN
                 OPEN(UNIT=17,FILE='STAT9.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
                 OPEN(UNIT=4,FILE='GARBL9.TXT',STATUS='NEW',
     1             CARRIAGECONTROL='LIST')
        ENDIF
C
C
C     DRAW A RANDOM NUMBER TO DETERMINE IF MESSAGE IS LOSS.
C     IF LOSS, GO GET THE NEXT ADDRESSEE.
C
      URAN=RAN(SEED)
      IF(URAN.LE.PLOSS(LNKTYP)) THEN
        WRITE(17,*)'  '
        WRITE(17,*)'  '
        WRITE(17,*)' IF URAN = ',URAN,'IS LESS THAN P(IOSS) = ',
     1PLOSS(LNKTYP),' MESSAGE IS LOST'
        WRITE(17,*)' GARBLE RATE ',LNKTYP,' = ',GRBRAT(INKTYP)
        WRITE(17,*)' LOSS RATE ',LNKTYP,' = ',PLOSS(LNKTYP)
        WRITE(17,*)' LINK TYPE = ',LNKTYP
```

```
          WRITE(17,*)' LINK CODE = ',LNKCOD
          WRITE(17,*)' I_CKT = ',I_CKT
          CLOSE (UNIT=17)
          WRITE(12,*)'CONTROLLER'
          WRITE(12,1Ø1Ø)'GARBL',INX,'.TXT'
C
          GOTO 5ØØ
        ENDIF
C
  12Ø URAN=RAN(SEED)
C
C       CALCULATE DELAY TIME BASE ON ARRIVAL RATE AND SERVICE RATE
C       OF THE CIRCUIT.
C
        IF( URAN .LT. Ø.1 .OR. URAN .GT. Ø.9 ) GO TO 12Ø
C
        IF ( LNKTYP .EQ. 6 ) THEN
                DELAY = Ø.Ø
          ELSE
                ARR= 1. / ( -1*(1./A(LNKTYP) ) * LOG1Ø(URAN) )
                SERV= 1. / ( -1*(1./S(LNKTYP) ) * LOG1Ø(URAN) )
                DELAY=( ARR / ( SERV * (SERV-ARR) ) / FACTOR )
        ENDIF
C
C
C
        HRS=INT(DELAY)
        MINUTS=INT(6Ø.*(DELAY-FLOAT(HRS)))
        SECS=INT(36ØØ.*(DELAY-FLOAT(HRS)-FLOAT(MINUTS)/6Ø.))
C
C
C       FIXED GARBLE RATES FOR EACH CIRCUIT TYPE.
C
        IF( LNKTYP .EQ. 6 ) THEN
                             FGARB=Ø.Ø
```

```
         ELSE IF( LNKTYP .EQ. 5 ) THEN
                                  PGARB= FLOAT( IPGARB(5) ) / 1ØØ.
         ELSE IF( LNKTYP .EQ. 4 ) THEN
                                  PGARB= FLOAT( IPGARB(4) ) / 1ØØ.
         ELSE IF( LNKTYP .EQ. 3 ) THEN
                                  PGARB= FLOAT( IPGARB(3) ) / 1ØØ.
         ELSE IF( LNKTYP .EQ. 2 ) THEN
                                  PGARB= FLOAT( IPGARB(2) ) / 1ØØ.
         ELSE IF( LNKTYP .EQ. 1 ) THEN
                                  PGARB= FLOAT( IPGARB(1) ) / 1ØØ.
      ENDIF
C
C
      INDEX = I
C
  13Ø CONTINUE
      URAN=RAN(SEED)
C
C     DETERMINE IF MESSAGE IS TO BE GARBLED
C
      IF(URAN.LE.PGARB)  THEN
        WRITE(17,*)'  '
        WRITE(17,*)'  '
        WRITE(17,*)' MESSAGE GARBLED'
        WRITE(17,*)'  '
        GO TO 1111
      ENDIF
C
  131 CONTINUE
      READ(3,1ØØ4,END=2ØØØ,ERR=2ØØØ)DATA1
      WRITE(4,1ØØ4)DATA1
      GO TO 131
 2ØØØ CONTINUE
      CLOSE(UNIT=4)
      REWIND 3
```

```
C
  132 CONTINUE
      WRITE(12,*)ADDNAM
      WRITE(12,1010)'GARBL',INX,'.TXT'
C
C     FORMAT DELAY TIME FOR DIGITAL COMMAND LANGUAGE COMMAND 'WAIT'
C
C
C
       IF( MINUTS .LT. 10 .AND. SECS .LT. 10 ) THEN
                WRITE(12,1020)HRS,':Ø',MINUTS,':Ø',SECS,'.ØØ'
                WRITE(17,*)'  '
                WRITE(17,*)' MESSAGE DELAY TIME FOLLOWS:  '
                WRITE(17,1020)HRS,':Ø',MINUTS,':Ø',SECS,'.ØØ'
                WRITE(17,*)'  '
        ELSE IF (MINUTS .LT. 1Ø .AND. SECS .GE. 1Ø ) THEN
                WRITE(12,1021)HRS,':Ø',MINUTS,':',SECS,'.ØØ'
                WRITE(17,*)'  '
                WRITE(17,*)' MESSAGE DELAY TIME FOLLOWS: $ '
                WRITE(17,1021)HRS,':Ø',MINUTS,':',SECS,'.ØØ'
                WRITE(17,*)'  '
        ELSE IF (MINUTS .GE. 1Ø .AND. SECS .LT. 1Ø ) THEN
                WRITE(17,*)'  '
                WRITE(12,1022)HRS,':',MINUTS,':Ø',SECS,'.ØØ'
                WRITE(17,*)' MESSAGE DELAY TIME FOLLOWS: $ '
                WRITE(17,1022)HRS,':',MINUTS,':Ø',SECS,'.ØØ'
                WRITE(17,*)'  '
        ELSE
                WRITE(17,*)'  '
                WRITE(12,1023)HRS,':',MINUTS,':',SECS,'.ØØ'
                WRITE(17,*)' MESSAGE DELAY TIME FOLLOWS: $ '
                WRITE(17,1023)HRS,':',MINUTS,':',SECS,'.ØØ'
                WRITE(17,*)'  '
       ENDIF
C
```

```
C        SAVING STATISTICAL DATA
C
         WRITE(17,*)' IF URAN = ',URAN,' LESS THAN  PGARB ',PGARB,' GARBLE IT'
         WRITE(17,*)' GARBLE RATE ',LNKTYP,' = ',GRBRAT(LNKTYP)
         WRITE(17,*)' LOSS RATE ',LNKTYP,' = ',PLOSS(LNKTYP)
         WRITE(17,*)' LINK TYPE = ',LNKTYP
         WRITE(17,*)' LINK CODE = ',LNKCOD
         WRITE(17,*)' I_CKT = ',I_CKT
         WRITE(17,*) 'SERVICE RATE = ',SERV
         WRITE(17,*) 'ARRIVAL RATE = ',ARR
         WRITE(17,*) 'FACTOR = ',FACTOR
         WRITE(17,*) 'LINK TYPE = ',LNKTYP
         WRITE(17,*) 'DELAY = ',DELAY
C
      CLOSE(UNIT=17)
C
  1ØØ CONTINUE
      CLOSE(UNIT=5)
      CLOSE(UNIT=12)
      CLOSE(UNIT=2)
      CLOSE(UNIT=1)
C
C
      IF (I_CKT .EQ. Ø ) THEN
         OPEN(UNIT=1Ø,FILE='SEEDØ.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 1 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED1.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 2 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED2.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 3 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED3.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 4 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED4.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 5 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED5.DAT',STATUS='UNKNOWN')
      ELSE  IF (I_CKT .EQ. 6 ) THEN
         OPEN(UNIT=1Ø,FILE='SEED6.DAT',STATUS='UNKNOWN')
      ENDIF
C
      REWIND 1Ø
      WRITE(1Ø,*)SEED
      CLOSE(UNIT=1Ø)
C  PLACE THE LAST VALUE OF SEED INTO 'SEED7.DAT'
      OPEN(UNIT=16,FILE='SEED7.DAT',STATUS='UNKNOWN')
      WRITE(16,*)SEED7
      CLOSE(UNIT=16)
      GO TO 999
C
C  THE LIB$DO OR LIB$RUN COMANDS MAY BE USED HERE TO EXECUTE OTHER
C  PROCEDURES SUCH AS A STATISTICAL PACKAGE
  999 STATUS = LIB$DO_COMMAND('DUMMY := "DUMMY"')
C
 2101 CONTINUE
C
C
                IF ( ICODE(6) .EQ. '1' ) THEN
                        LNKTYP = 6
                  ELSE IF ( ICODE(1) .EQ. '1' ) THEN
                        LNKTYP = 1
                  ELSE IF ( ICODE(2) .EQ. '1' ) THEN
                        LNKTYP = 2
                  ELSE IF ( ICODE(3) .EQ. '1' ) THEN
                        LNKTYP = 3
                  ELSE IF ( ICODE(4) .EQ. '1' ) THEN
                        LNKTYP = 4
                  ELSE IF ( ICODE(5) .EQ. '1' ) THEN
                        LNKTYP = 5
                  ELSE
                        GO TO 5ØØ
                ENDIF
```

```
c
c
      GO TO 2102
c
 1111 CONTINUE
c
c***********************************************************************
c                          GARBLE MODULE
c***********************************************************************
c  This subroutine takes a single line of text and changes a percentage of the
c  characters by randomly replacing them with other characters as well as
c  carriage return and line feed.
c
c  DICTIONARY
c     garvel: the percentage of garbling to applied against the text line
c             (value will remain constant for the entire message).
c     inline: the input character line (max length = 80).
c     link: the type of circuit the message is being transmitted over
c           (each link will have a pre-determined percent garbling)
c     otline: the output line with garbled text
c
c
  151 continue
      read(2,1004,end=150)data2
c
c  Line garbling is accomplished a single character at a time with the
c  modification taking place on 'inline/otline' via 'newltr' equivalence.
c  Rate of garbling set by 'garble()' for a particular link.
      do 910 i=1,80
         rannum=ran(seed7)
c  The next number generated determines replacement character.
         ltrnum=INT((rannum+(1.0/59.))*59.)
c  The next number determines if the character will be garbled.
         rannum=ran(seed7)
         if(rannum.gt.grbrat(lnkty))go to 910
```

```
c  If ltrnum equals 58 linefeed will be substituted.
          if(ltrnum.eq.58)then
          newltr(i)=char(10)
          go to 910
          endif
c  If ltrnum equals 59 linefeed is substituted for the previous character
c  and carriage return for the current character.
          if(ltrnum.eq.59)then
          newltr(i-1)=char(10)
          newltr(i)=char(13)
          go to 910
          endif
c  If ltrnum is less than 58 the new value is taken from letter(ltrnum).
          newltr(i)=letter(ltrnum)
  910 continue
c  Final output line is now created through data2 and newltr equivalence.
      write(4,1004)data2
      go to 151
 9998 write(6,990)
  150 go to 152
 1100 format(a1)
  990 format(2x,'input error in letter.txt')
 1004 FORMAT(A)
 1000 FORMAT(I2/A10)
 1010 FORMAT(A5,I1,A4)
 1020 FORMAT(I2,A2,I1,A2,I1,A3)
 1021 FORMAT(I2,A2,I1,A1,I2,A3)
 1022 FORMAT(I2,A1,I2,A2,I1,A3)
 1023 FORMAT(I2,A1,I2,A1,I2,A3)
      END
```

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